9-13 December 2012

Australian Institute of Physics Congress
Incorporating the 37th Australian Conference on Optical Fibre Technology

THE UNIVERSITY OF NEW SOUTH WALES
2012 SYDNEY

www.aip2012.org.au
Open the door to collaboration

From developing antibodies to creating lighter metals for next generation aircraft, our materials science division offers scientists incredible opportunity to work on diverse projects with real industrial impact.

A critical part of our science and our success is collaboration. We thrive on working with new people with new perspectives.

Opportunities for collaboration

- CSIRO studentships
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The Institute for Photonics & Advanced Sensing (IPAS) is one of five research institutes at The University of Adelaide. IPAS fosters excellence in research in materials science, chemistry, biology and physics, and across these boundaries, and develops disruptive new tools for measurement.

IPAS creates the opportunity to invent and harness new tools for measurement to address many of the current exciting big questions in science. Many of the challenges we face as a society can only be solved by pursuing a transdisciplinary approach that brings together experimental physicists, chemists, material scientists, biologists, experimentally-driven theoretical scientists and medical researchers to create new sensing and measurement technologies.

We work to create new tools that will change the questions scientists can ask, stimulate the creation of new industries, and create a new profession of transdisciplinary problem solvers.

Our research is focused around six Research Themes, which interconnect and allow us to tackle the major challenges facing Australia and the world and which offer particular opportunities for the development of new and disruptive technologies. An overview of these themes can be seen in a short video, which can be found at http://www.adelaide.edu.au/ipas/.

We work on a wide spectrum of projects that range from fundamental to applied research projects, which gives us a feedstock of new approaches to bring to practical problems and opportunities to drive world-class research as well as engage closely with industry. The list below shows a cross section of some of the applications we are working on with industrial and government partners in specific market sectors:

- **Defence & national security** – corrosion detection, high power lasers and luminescence techniques.
- **Environmental & agricultural monitoring** – laser radar systems for monitoring wind, moisture and pollution in the atmosphere, sensors for monitoring soil and water quality.
- **Medical diagnostics** – rapid virus detection to help prevent global flu pandemics, early detection of cancer biomarkers and technologies to improve IVF success rates.
- **Food & wine** – monitoring of wine maturation, soil nutrient monitoring.

We are always seeking excellent scientists to join the team at IPAS – please visit our website www.adelaide.edu.au/ipas/ to find out more about the opportunities we have available.
Welcome from the Congress Chair

On behalf of the Australian Institute of Physics and the New South Wales Branch, it is my pleasure to welcome you to the 20th Australian Institute of Physics Congress held at the University of New South Wales over the coming week.

Co-located with the 37th Australian Conference on Optical Fibre Technology (ACOFT), the AIP/ACOFT 2012 Congress is the biggest and most diverse scientific meeting of the Australian physics calendar in 2012.

The Congress once again has attracted many of Australia’s finest physicists plus a number of prominent overseas Plenary Speakers and attendees, representing over 14 different countries.

It provides a forum for discussions within specialist physics topic areas and opportunities for physicists from academia, government, industry and the commercial sector to keep up to date in areas outside their core interests. The Congress brings together approximately 20 special interest groups and, as was achieved in 2010, the incorporation of ACOFT will attract specialists working on diverse research applications of optical fibre technology.

Over the next four days I encourage you to maximise the opportunity to engage in plenary lectures, parallel sessions, poster sessions, a public lecture, industry workshops and poster sessions. In addition, please spend time in the exhibition area learning more about the latest products and services available in the marketplace.

Of course the social elements of the Congress allow for networking and engagement with your peers and colleagues so I look forward to seeing you at the Welcome Reception and Congress Dinner.

Thank you for taking the time to join us at the Congress and I hope you find the experience informative and enjoyable.

Dr Cathy Foley
Congress Chair

Welcome from the AIP President

Welcome to the 20th Australian Institute of Physics Congress, incorporating the 37th Australian Conference on Optical Fibre Technology (ACOFT). Once again many of our cognate societies have joined us at the Congress to hold their specialist meetings. Some of these are here for the first time like the Australian Society of Rheology and so we look forward to learning about new and varied areas of physics.

This has been a very special year for physics in Australia with Brian Schmidt (one of our plenary speakers) winning the Nobel Prize for Physics, the announcement of Western Australia as the selected site for the low frequency component of the Square Kilometre Array, operating funds for the Australian Synchrotron secured and the announcement, jointly at CERN and in Melbourne at the 36th International Conference on High Energy Physics, of the observation of the Higgs boson. We will hear about all these things and more.

In addition we start the 50th anniversary year of the Australian Institute of Physics at this Congress and there will be some announcements about activities for the year and new initiatives as part of the celebrations of our semi-centenary.

Running such a large and diverse meeting of physicists requires a team of dedicated and hard working people and I would like to thank the people behind the scenes who have made this meeting possible: Cathy Foley and her local Organising Committee; Rob Robinson and his Scientific Program Committee; the host organisations (AIP, AOS, ACOFT & Engineers Australia); and WALDRONSMITH Management our Conference Organisers and AIP Secretariat providers.

I wish all participants an enjoyable and productive Congress.

Dr Marc Duldig
President – Australian Institute of Physics
L’Oréal For Women in Science has grown into a global program that includes International, Regional and National Fellowships and an international network of more than 1,300 women in 106 countries. Each year, the national L’Oréal For Women in Science Fellowship awards three early career, female scientists with AUD$25,000 for their remarkable contributions in science. Applications for the 2013 Australian & New Zealand Fellowships reopen in April, 2013. www.forwomeninscience.com

Dr Baohua Jia
Swinburne University of Technology, Melbourne, Australia.
More efficient solar cells using quantum dots.

Dr Suetonia Palmer
University of Otago, Christchurch, New Zealand.
Giving people with kidney disease control of their lives.

Dr Kylie Mason
Walter and Eliza Hall Institute of Medical Research / Royal Melbourne Hospital. New treatments for blood cancers.

2012 AUSTRALIA & NEW ZEALAND
L’ORÉAL FOR WOMEN IN SCIENCE FELLOWS
WE SUPPORT WOMEN WHO MOVE SCIENCE FORWARD.

Beamtime Applications

Add your name to the list of over 3,000 users who have accessed the Synchrotron’s unique capabilities as we celebrate our first five years of operation.

Submission dates for beamtime proposals at the Australian Synchrotron have been announced for 2013 access:

- **User Beamtime:**
  - May – September 2013
  - September – December 2013

- **Call for proposals opens:**
  - 10:00am, 12 December 2012
  - 10:00am, 8 May 2013

- **Call for proposals closes:**
  - 11:59pm, 13 February 2013
  - 11:59pm, 5 June 2013

For more information on how to apply for beamtime at the Australian Synchrotron, please visit our website:

www.synchrotron.org.au

turning bright ideas into brilliant outcomes
AIP 2012 Congress proudly sponsored by
UNSW School of Physics

Media

Science in Public is assisting with the Congress media program. The Media Room is located in the Gonski Room in the John Niland Scientia Building. Alternatively you may contact Niall Byrne on mobile 0417 131 977 or email niall@scienceinpublic.com.au; or AJ Epstein on mobile 0433 339 141 or email aj@scienceinpublic.com.au

For further information visit: www.scienceinpublic.com.au/physicscongress

Congress Organisers

WALDRON SMITH Management
We bring people together and your conference to life
119 Buckhurst Street
South Melbourne VIC 3205 Australia
T +61 3 9645 6311
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Work with us and our specialised facilities to **ask** and answer the **big questions**.

**ANSTO’s Bragg Institute** is a world leader in neutron and X-ray scattering techniques, and houses the region’s most comprehensive suite of neutron beam instruments.

**Pictured:** ANSTO’s OPAL reactor building.

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Organising Committee

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Dr Scott Martin (CSIRO), Treasurer
A/Prof Judith Dawes (Macquarie University), Australian Optical Society
Dr Rob Robinson (ANSTO), Scientific Program Committee Chair
Dr Matt Arnold (University of Technology Sydney)
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Scientific Program Committee

Dr Rob Robinson (ANSTO), Condensed Matter Materials and Surface Physics, Chair
Dr John Arkwright (CSIRO), Australian Conference on Optical Fibre Technology
Prof Stephen Bartlett (University of Sydney), Quantum Information, Concepts and Coherence
Dr David Cohen (ANSTO), Environmental Physics
Dr Steve Gibson (Australian National University) Atomic and Molecular Physics
Dr Pulin Gong (Sydney University), Complex Systems, Computational and Mathematical Physics
Dr Tibor Kibedi (Australian National University), Nuclear Physics
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A/Prof John O’Byrne (University of Sydney), Astronomical Society of Australia
A/Prof Manju Sharma (University of Sydney), Education
A/Prof Michael Steel (Macquarie University), Australian Optical Society
Dr John Steele (University of NSW), Australasian Society for General Relativity and Gravitation
Prof Billy Todd (Swinburne University), Australian Society of Rheology
A/Prof Kevin Varvell (University of Sydney), Particle Physics
Prof Graham Town (Macquarie University), IEEE Photonics Society

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Dr Brendan Kennedy, University of Western Australia
Dr Sergio Leon-Saval, University of Sydney
A/Prof Steve Madden, Australian National University
Prof Graham Town, Macquarie University

Acoustics, Music and Ultrasonics
Dr Rob Robinson, ANSTO

Astronomy and Astrophysics
Dr Kate Brookes, CSIRO
A/Prof John O’Byrne, The University of Sydney
Dr Katrina Sealey, Australian Astronomical Observatory
Prof Lister Staveley-Smith, University of Western Australia

Atomic and Molecular Physics
Prof Michael Brunger, Flinders University
Dr Jason Gascooke, Flinders University
Dr Stephen Gibson, Australian National University
Prof Anatoli Kheifets, Australian National University
Dr James Sullivan, Australian National University
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Biomedical Physics and Biophysics
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Dr Adam Hill, Victor Chang Cardiac Research Institute
Dr Michael Lerch, University of Wollongong
Prof Steve Meikle, University of Sydney
Prof Peter Metcalfe, University of Wollongong
Dr Marco Petasecca, University of Wollongong
Dr Yujin Qi, University of Wollongong
Prof Anatoly Rozenfeld, University of Wollongong
Dr Mitra Safavi-Naeini, University of Wollongong
Dr Moeava Tehei, University of Wollongong
Prof Jamie Vandenberg, Victor Chang Cardiac Research Institute

Complex Systems, Computational and Mathematical Physics
Prof Pulin Gong, University of Sydney
Prof Jaan Oitmaa, University of NSW

Condensed Matter, Materials and Surface Physics
Dr Jodie Bradby, Australian National University
Dr Cathy Foley, CSIRO
Prof Roger Lewis, University of Wollongong
Dr Rob Robinson, ANSTO
A/Prof Clemens Ulrich, University of NSW

Education
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Dr John Furst, University of Newcastle
Dr David Hoxley, La Trobe University
A/Prof Manjula Sharma, University of Sydney
Dr Jim Webb, Griffith University

Energy, Energy Materials and Energy Systems
Dr Rob Robinson, ANSTO

Environmental Physics
Prof Dave Cohen, ANSTO

History of Physics and Industry
Dr Rob Robinson, ANSTO

Meteorology, Climate Change and Oceanography
Prof John Dodson, ANSTO

Nuclear and Particle Physics
Dr Tibor Kibedi, Australian National University
A/Prof Kevin Varvell, University of Sydney

Optics, Photonics and Lasers
A/Prof Michael Steel, Macquarie University (Chair)
Dr Chad Husko, University of Sydney
Dr Maryanne Large, Canon Information Systems Research Australia
Dr Christopher Poulton, University of Technology Sydney
A/Prof Timothy Schmidt, University of Sydney
A/Prof David Spence, Macquarie University
Plasma Science
A/Prof Brian James, University of Sydney
Dr Tony Murphy, CSIRO

Quantum Information, Concepts and Coherence Group
Prof Stephen Bartlett, University of Sydney
A/Prof Warwick Bowen, University of Queensland
A/Prof Matthew Davis, University of Queensland
Prof Geoff Pryde, Griffith University
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Prof David Reilly, University of Sydney
Dr Tom Stace, University of Queensland
Dr Andrew Truscott, Australian National University

Relativity
Prof Susan Scott, Australian National University
Dr John Steele, University of NSW
Dr Ben Whale, University of Otago

Rheology
Dr Ahmad Jabbarzadeh, University of Sydney
Dr Ravi Jagadeeshan, Monash University
Dr Timothy Nicholson, University of Queensland
Dr Prabhabar Ranganathan, Monash University
Dr Anthony Strickland, University of Melbourne
Prof Billy Todd, Swinburne University of Technology

Solar, Terrestrial and Space Physics
Dr Iver Cairns, University of Sydney
Dr Marc Duldig, University of Tasmania
Dr Trevor Harris, DSTO
Prof Fred Menk, University of Newcastle
Dr Dave Neudegg, Bureau of Meteorology & Australian Ionospheric Prediction Service
Prof Iain Reid, University of Adelaide

Women in Physics
Dr Cathy Foley, CSIRO

IPOS
INSTITUTE OF PHOTONICS AND OPTICAL SCIENCE

The Institute of Photonics and Optical Science (IPOS) brings together photonics and optics research across the University of Sydney. IPOS is home to state of the art research facilities, including:

IPOS Research Laboratories
Some facilities are part of the Australian National Fabrication Facility (ANFF) Opto-Fab node, and can be accessed by Australian researchers.

Bandwidth Foundry International (BFI)
BFI has micro- and nano-fabrication capabilities and supports a wide range of research in photonics and semiconductors, as well as the education and training of postgraduate students.

Australian Institute of Nanoscience (AIN)
The AIN is a major new nanoscience fabrication and experimental facility underpinning research in photonics, quantum science, astronomy and space physics and materials.

For information please visit sydney.edu.au/pos
The Congress gratefully acknowledges the support from its sponsors.

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- ANFF Workshop: Introduction to Fabrication for Semiconductors, Optics and Photonics
- Joint: Optics, Photonics and Lasers + Condensed Matter, Materials and Surface Physics (X-ray Optics)
- Women in Physics Session

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Integral to the Congress is a valued exhibition allowing you the opportunity to meet and view the latest products and services available in the market place.

Located in Leighton Hall on the ground floor and Tyree Room on level 1 of the John Niland Scientia Building, the exhibition will be open the following times:

- Sunday 09 December 2012 1700 – 1900 hrs
- Monday 10 December 2012 0800 – 1830 hrs
- Tuesday 12 December 2012 0800 – 1730 hrs
- Wednesday 12 December 2012 0800 – 1830 hrs
- Thursday 13 December 2012 0800 – 1530 hrs

The Scientific Posters and Exhibition have been combined in the same areas. Posters will be available for viewing from 0800hrs Monday – 1530hrs Thursday or the designated poster session time.

Exhibition Floor Plan

LEIGHTON HALL – Ground Floor

TYREE ROOM – Level 1
**Venue**

The University of New South Wales (UNSW) is the host venue for the Congress. Established in 1949, it is one of Australia’s leading research and teaching universities.

**Address:**
High Street, Kensington, NSW 2052 Australia
www.unsw.edu.au

The Registration and Information Desk, Speaker Preparation Room, Media Room, Exhibition and Posters will be located in the John Niland Scientia Building (refer to building G19 on map below). The Opening Plenary Session will be located in the Clancy Auditorium (refer to building C24 on the map below) whilst the remainder of Plenary and Concurrent Sessions will be held in the nearby Central Lecture Block (refer to building E19 on the map below).

Delegates are encouraged to enter via Gate 11 on Botany Road, Kensington.

**Directions and Transport**
Located 7kms from the Sydney CBD in Sydney’s Eastern suburbs, UNSW is well serviced by public transport. Onsite parking requires payment but, out of session, street parking is usually easy.

**Onsite Parking Facilities**
All day casual parking is generally available on the top floors of the Barker Street (Gate 14) and Botany Street (Gate 11) car parks. Sometimes this parking may not be available due to various other demands. Short-term, paid 2P parking is also available via most entrance gates.

**Getting there from Sydney Airport**
UNSW is only 6kms from Sydney Airport. Delegates can simply catch a taxi direct to UNSW or nearby accommodation or catch the Airport Train to the Central Station (www.airportlink.com.au) and then a bus or taxi to UNSW.

**Public Transport**
In regards to public transport, bus is the best method by which to get to the University.

Gate 9 on High Street is the stop closest to the bus stations.

Below are some suggested bus routes from key locations in Sydney:

- **From Central Station (Sydney CBD)**
  - 891 from Eddy Avenue Stand D
  - M50 from Elizabeth Street near Devonshire Street, Surry Hills

- **From Circular Quay (Sydney CBD)**
  - 377 from Circular Quay Stand D
  - 373 from Circular Quay Stand D

- **From Coogee Beach**
  - 370 from Arden Street
  - M50 from Arden Street

- **From Bondi Beach**
  - 333 from Campbell Parade to Bondi Junction, then 400 from Bondi Junction Interchange Stand E

**Important to Note:** The above are suggested routes to take with approximate journey times. It is recommended you refer to www.131500.com.au/plan-your-trip for further information.
General Information

ATM Facilities
The closest ATM facilities are a Westpac Bank located outside the Clancy Auditorium and a Commonwealth Bank located outside the Library.

Catering
Morning and afternoon tea will be served in Leighton Hall, where the Congress Exhibition will be held. Lunch is at your own arrangement and can be purchased at any of the food and beverage outlets located on Mathews Arcade, outside the Clancy Auditorium. There is also the Blue Stone Cafe which is located next to Central Lecture Block. Refreshments will be served during the Welcome Reception as well as both Poster Sessions.

CD of Proceedings
The CD of proceedings will be distributed at Registration.

Child Care Services
Sydney offers a wide range of activities and sights for your family to enjoy. If childcare or babysitting services are required, please contact your hotel concierge in advance for recommendations and bookings.

Climate
December in Sydney is the first month of summer with daytime temperatures reaching low 30 degrees Celsius. Evenings can be slightly cooler with an average of 16 degrees Celsius.

Credit Cards
Visa and MasterCard will be accepted at the Registration and Information Desk. Most hotels, large restaurants and shops will accept international credit cards, the most widely recognised being American Express, Diners Club, MasterCard and Visa.

Disclaimer
The AIP/ACOFT 2012 Congress, including the Congress Organisers, will not accept liability for the damages of any nature sustained by participants or their accompanying persons for loss or damage to their personal property as a result of Congress and Exhibition or related events. All details contained in this handbook are correct at the time of printing.

Exhibition
The Exhibition will be held at Leighton Hall in the John Niland Scientia Building.

Exhibition Opening Hours:
- Sunday 09 December 2012 1700 – 1900 hrs
- Monday 10 December 2012 0800 – 1730 hrs
- Tuesday 11 December 2012 0800 – 1730 hrs
- Wednesday 12 December 2012 0800 – 1730 hrs
- Thursday 13 December 2012 0800 – 1530 hrs

Insurance
Delegates are strongly advised to secure appropriate travel and health insurance. Delegate registration fees do not provide any such insurance coverage. The Congress Organising Committee and the Congress Office accept no responsibility for any loss in this regard.

Internet Access
Please note that wireless internet is available for all delegates on a complimentary basis. The UNSW Campus Wireless Network which will be used is called UniWide Guest.

To access UniWide, you will need a properly configured 802.11a/b/g/n (WiFi) compatible laptop computer or mobile device. Most new laptops and handheld wireless devices come with in-built 802.11a/b/g/n WiFi support. You can also purchase a Wireless Network Interface Card and install it into an existing laptop.

The Congress Office has sent registered delegates the password details and configuration and installation details in advance. If you require any further assistance please contact the Registration and Information desk.

Language
The official language of the Congress is English.

Name Badges
Your name badge is your entry to all sessions, the exhibition, inclusive social functions as well as morning and afternoon teas (all served in the exhibition area). Please wear your name badge at all times. The swapping of the Congress lanyard with your own lanyard is not permitted. Tickets are required for admission to all non inclusive social functions, and if purchased, will be issued with your name badge.

People with Special Needs
Every effort will be made to ensure that delegates with special needs are catered for. However any special requirements given onsite at the Congress, without prior notice, cannot be guaranteed to be catered for.

Registration and Information Desk
The Registration Desk and Information Desk is in the foyer of the John Niland Scientia Building and will be open during the following times:
- Sunday 09 December 2012 1300 – 1900 hrs
- Monday 10 December 2012 0730 – 1730 hrs
- Tuesday 11 December 2012 0730 – 1730 hrs
- Wednesday 12 December 2012 0730 – 1730 hrs
- Thursday 13 December 2012 0730 – 1700 hrs

Smoking Policy
Smoking is prohibited in all areas except within the designated smoking zones.

Speaker Preparation Room
Speakers will be able to review their presentations in the Speaker Preparation Room located in the Peter Farrell room in the John Niland Scientia Building as per the following times:
- Sunday 09 December 2012 1300 – 1900 hrs
- Monday 10 December 2012 0730 – 1700 hrs
- Tuesday 11 December 2012 0730 – 1700 hrs
- Wednesday 12 December 2012 0730 – 1700 hrs
- Thursday 13 December 2012 0730 – 1530 hrs

Time Zone
Sydney operates on Eastern Daylight Savings Time 11 hours ahead of GMT.

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Registration Entitlements

Registration Inclusions

Full Member Registrations
- Entry to program sessions
- Entry to the Exhibition
- Congress satchel and name badge
- Daily morning and afternoon tea
- Attendance at the Welcome Reception
- Attendance at poster sessions 1 & 2
- Option to attend the public lecture and associated workshops

Day Registrations
- Entry to program sessions (on designated day only)
- Entry to the Exhibition (on designated day only)
- Congress satchel and name badge
- Daily morning and afternoon tea (on designated day only)
- Attendance at the Welcome Reception, poster session 1 & 2 (if applicable on designated day only)
- Option to attend the public lecture and associated workshops

Lunch
Lunch is NOT included in registration fees.

Congress Dinner
The Congress Dinner (Tuesday 11 December 2012) is an ADDITIONAL social function and is NOT INCLUDED in any registration category. Ticket/s are available for purchase at a cost of $145 per person.

Undergraduate/Post Graduate Students or Unfunded Retirees
- Entry to program sessions
- Entry to the Exhibition
- Congress satchel and name badge
- Daily morning and afternoon tea
- Attendance at the Welcome Reception
- Attendance at poster sessions 1 & 2
- Option to attend the public lecture and associated workshops

Sponsors/Exhibitors
Entry to program sessions
- Entry to the Exhibition
- Congress satchel and name badge
- Daily morning and afternoon tea
- Attendance at the Welcome Reception
- Attendance at poster sessions 1 & 2
- Option to attend the public lecture and associated workshops

Congress Accommodation

Crowne Plaza Coogee
242 Arden Street
Coogee NSW 2034
T: 02 9315 7600
Distance to UNSW: 3.1km
Public bus service available (approximately 10 minutes)

Medina Executive Coogee
183 Coogee Bay Road
Coogee NSW 2034
T: 02 9578 6000
Distance to UNSW: 3km
Time Public Bus Service available (approximately 10 minutes)

New College Village
Corner of Anzac Parade and Day Avenue
Kensington NSW 2052
T: 02 8344 4500

Lunch
Lunch is NOT included in registration fees.

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Distance to UNSW: 3.1km
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Medina Executive Coogee
183 Coogee Bay Road
Coogee NSW 2034
T: 02 9578 6000
Distance to UNSW: 3km
Time Public Bus Service available (approximately 10 minutes)

New College Village
Corner of Anzac Parade and Day Avenue
Kensington NSW 2052
T: 02 8344 4500
Welcome Reception
Proudly sponsored by:
**IOP Institute of Physics**

Sunday 09 December 2012
Time: 1700 – 1900 hrs
Venue: Exhibition Area
John Niland Scientia Building
Dress: Smart Casual
Inclusive: Registered delegates
Enjoy a selection of canapés and drinks as you mingle throughout the Exhibition. It is a great opportunity to catch up with old friends and make new acquaintances.

Poster Sessions
Proudly sponsored by:

Poster Sessions will be held over two days in the Exhibition area and are available to all registered delegates.
Posters will be scheduled according to topic with presenting authors available at the poster board for informal discussion. Light refreshments will be served.

**Poster Session 1**
Monday 10 December 2012
1700 – 1830 hrs

**Poster Session 2**
Wednesday 12 December 2012
1700 – 1830 hrs

Congress Dinner
Proudly sponsored by:

**ANSTO**

Tuesday 11 December 2012
Time: 1900 – 2300 hrs
Venue: Dockside
Cockle Bay Wharf
Darling Harbour
Dress: Smart Casual
Cost: $145 per person

The Congress dinner is an ADDITIONAL social function and is not included in ANY registration category.
Dockside is ideally positioned within Cockle Bay Wharf, Darling Harbour. With sparkling water and panoramic views stretching over Darling Harbour, Dockside blends function and space with a reputation for culinary excellence and exceptional service. An ideal evening to sit and enjoy some great food, wine and conversation.
Coach transfers will be available departing from the Gate 11, UNSW to the Congress Dinner Venue as follows;
- 1815 hrs
- 1830 hrs – Last bus
We will also have return coach transfers starting from 2230 hrs with the last bus leaving at 2315 hrs to take delegates back to UNSW, Crown Plaza Coogee and Medina Executive Coogee
AIP – Medals and Awards

The Congress will highlight contributions to Physics through the awarding of prizes for excellence. These will be awarded at the Congress dinner on Tuesday evening.

Alan Walsh Medal for Service to Industry
This award recognises significant contributions by a practising physicist to industry in Australia. It commemorates the late Sir Alan Walsh, Kt, FAA, FTS, FRS, one of Australia’s most eminent and distinguished scientists, who was the originator and developer of Atomic Absorption Spectrophotometry (AAS) and pioneered its application as a tool in chemical analysis.

Born in Lancashire in 1916 and educated at Darwen Grammar School, Sir Alan studied physics at Manchester University. After a few years in industry in the UK, he was recruited in 1946 to join the newly created Chemical Physics Section of the CSIR Division of Industrial Chemistry in Melbourne. In 1952 he had the idea of using atomic absorption spectra, rather than atomic emission and molecular absorption spectra, in spectrochemical analysis. The subsequent development of AAS as a simple, rapid and inexpensive method for the analysis of minute traces of metals (and some non metals) is a tribute to Sir Alan’s extraordinary creativity, his business acumen and his infectious enthusiasm. He promoted the establishment of an Australian manufacturer of the atomic absorption spectrophotometer, the original company Techtron Pty Ltd eventually growing into Varian Australia, now one of the world’s leading spectroscopic instrument companies.

Winners: Prof Michael Tobar and Prof Eugene Ivanov for their outstanding research in the development of ultra low noise sapphire microwave oscillators, and their contributions to, and continuing involvement in, the realisation of commercial applications of this technology.

Bragg Gold Medal for Excellence in Physics
The Bragg Gold Medal for the best PhD thesis by a student from an Australian University was established in 1992 as an initiative of the South Australian Branch, to commemorate Sir Lawrence Bragg and his father Sir William Bragg. The medal is awarded annually to the student who is judged to have completed the most outstanding PhD in physics under the auspices of an Australian University.

Winner: Dr Eva Kuhnle from the Swinburne University of Technology for her thesis titled: “Studies of Universality in Strongly Interacting 6Li Fermi Gases with Bragg Spectroscopy”

Nature distinguishes between particles with integer spin and half-integer spin, bosons and fermions, respectively. At very low temperatures bosons can undergo Bose-Einstein condensation while fermions need to interact with another fermion of opposite spin to form a Fermi superfluid. A possible system to study pairing mechanisms of fermions is an ultracold gas of 4He atoms where the sign as well as strength of the interaction is tunable. In the thesis of Dr Kuhnle, such a system was employed to form a dilute strongly interacting Fermi gas on which Bragg spectroscopy was performed to measure structure factors and the universal contact parameter for short-range pair correlations.

Harrie Massey Medal and Prize
This prize is awarded every two years for contributions made by an Australian physicist working anywhere in the world, or to a non-Australian for work they have carried out in Australia.

The Massey Medal was proposed at the AIP Congress in 1988 and established in 1990 as a gift of the Institute of Physics, UK, to mark the 25th anniversary of the founding of the AIP as a separate institution in 1963.

Sir Harrie Massey, born near Melbourne in 1908, had a distinguished career in the UK and in 1931, with Edward Bullard, published the first experimental evidence for electron diffraction in gases. He saw the potential of using direct rocket probes of the atmosphere layers and eventually, as Chairman of the British National Committee for Space Research, he guided the entire UK space research program. From 1960 – 64 he was President of the European Preparatory Commission for Space Research. He was knighted in 1960.

Winner: Dr Tony Murphy for his outstanding research in the field of thermal plasmas, in particular his work on computational modelling and measurement techniques, and their application to the development of industrial processes.
AIP – Medals and Awards – continued

AIP Education Medal
The purpose of this prize is to recognise an outstanding contribution to physics education in Australia.
The award was proposed as an initiative of the Physics Education Group at the 2002 AIP Congress in Adelaide. The prize is awarded to any member of the AIP who is judged to have made a significant contribution to physics education in Australia. In determining the recipient of the award, the quality of the work, the significance to physics education and the creativity displayed will be taken into account.

Winner: A/Prof Manjula Sharma from the University of Sydney
A/Prof Manjula Sharma has significantly contributed to physics education in Australia. Her contribution has been sustained, as demonstrated by service over many years. The creativity and quality of her work is evidenced by repeated research funding, research publications, peer reviewed articles and citations. Her work has been of national importance which is clearly demonstrated by her leadership of national physics teaching initiatives. A/Prof Sharma is also the Leader of SaMnet, the Science and Mathematics network of Australian University Educators, representing physics education in the broader community. Her work is recognised internationally through research partnerships and service on the Editorial Board of Physical Reviews – Special Topic Physics Education Research and Scientific Advisory Committee of the World Conference on Physics Education.

A/Prof Sharma will be present at Congress on the changing face of education and the challenges and opportunities for physics.

Walter Boas Medal
The Medal was established in 1984 to promote excellence in research in Physics and to perpetuate the name of Walter Boas. The award is for physics research carried out in the five years prior to the date of the award, as demonstrated by both published papers and unpublished papers prepared for publication.

2011 Winner: Prof Ben Eggleton
Prof Eggleton was awarded the 2011 Boas Medal for his fundamental research in the physics of non-linear optics and the application of this work to the development of practical devices and disruptive technologies in optical communication, data storage and information processing. His work is unquestionably world-leading. Particularly impressive highlights are the development of chalcogenide materials for non-linear optics applications and the ability to precisely control the flow of light via innovative photonic-crystal structures. Prof Eggleton’s establishment and leadership of CUDOS and IPOS augurs well for the future of this exciting work.

AIP Women in Physics Lecturer
The Australian Institute of Physics Women in Physics Lecture Tour celebrates the contribution of women to advances in physics. Under this scheme, a woman who has made a significant contribution in a field of physics gives lectures across the country to both specialist and non-specialist audiences. Presentations include school lectures, public lectures and research colloquia. Public lectures are expected to increase awareness among students and their families of the possibilities offered by a career in physics. In 2009 the Women in Physics group suggested that a medal should be awarded to each one of these remarkable women in order to recognise the outstanding contribution they have each made to physics.

Many of these medals were presented retrospectively to the AIP Women in Physics Lecturers at the 2010 Congress in Melbourne. The presentation to those recipients who were not able to attend the 2010 Congress and who are present at the 2012 will be made at this Congress. Awards still to be presented are listed below.

2011 – Dr Tamara Davis, Department of Physics, The University of Queensland
2006 – Prof Deb Kane, Physics Department, Macquarie University
2002 – A/Prof Lidia Morawska, School of Physical and Chemical Sciences, Queensland University of Technology
2000 – Dr Michelle Simmons, School of Physics, University of New South Wales
1997 – Dr Rachel Webster, School of Physics, University of Melbourne

AOS – Prize Winners
The Australian Optical Society proudly announces the 2012 AOS Prize winners:

AOS W.H. (Beattie) Steel Medal
Prof Barry Luther-Davies
Awarded for outstanding contributions to the field of Optics within Australia. The AOS Medal is named in honour of WH (Beattie) Steel, one of the founders of the AOS, and an international authority on interferometry. We congratulate Prof Barry Luther-Davies as a distinguished winner of this award, for his achievements in lasers and nonlinear optics over many years.

AOS Geoff Opat Early Career Researcher Prize
Dr Nathan Langford
Recognising an outstanding early career researcher for his contribution to the field of optics.
Public Lecture

The Accelerating Universe

In 1998 two teams traced back the expansion of the universe over billions of years and discovered that it was accelerating, a startling discovery that suggests that more than 70% of the cosmos is contained in a previously unknown form of matter, called Dark Energy. The 2011 Nobel Laureate for Physics, Brian Schmidt, leader of the High-Redshift Supernova Search Team, will describe this discovery and explain how astronomers have used observations to trace our universe’s history back more than 13 billion years, leading them to ponder the ultimate fate of the cosmos.

A free public lecture will be held on Wednesday 12 December 2012 at the University of NSW at the Central Lecture Block Room 7 from 1830 – 2000 hrs presented by the 2011 Nobel Prize winner Prof Brian Schmidt.

Sponsored by NSW Office of Science & Research, Department of Trade and Investment

sydneyaustralia.com
You are invited to a workshop to learn how to connect your research with industry. Learn from four industry leaders as they share their insights and experiences with you on issues such as how to identify market opportunities, spinoffs versus technology licensing, the importance of patenting, business plans and venture capital, mentoring, etc. A valuable opportunity not to be missed.

The workshop is included for registered delegates at no extra cost and limited numbers are available.

Date: Sunday 09 December 2012
Registration: John Niland Scientia Building
Registration: 1330-1400 hrs
Workshop: 1400-1700 hrs
Welcome by Prof Mary Kane, NSW Chief Scientist and Engineer
Session Chaired by Prof Ben Eggleton

Presenters Include:
1415 hrs  Dr Milton Chang – US based Entrepreneur
1455 hrs  Dr Simon Poole, Sydney based Photonics Entrepreneur
1520 hrs  Prof John Harvey, NZ based Entrepreneur and Physics Professor
1545 hrs  A/Prof Jim Patrick, Senior Vice President, Chief Scientist, Cochlear Pty Ltd

Dr Milton Chang
US based Entrepreneur

Dr Milton Chang is Managing Director of Incubic management and is the Author of Toward Entrepreneurship (www.miltonchang.com). He was President of Newport and New Focus, which he took public. He is currently Director of MBio Diagnostics, and Aurrion, spends time advising companies and mentoring entrepreneurs, and writes a monthly business column for the Laser Focus World. Chang is currently a member of the SEC Advisory Committee on Small and Emerging Companies and a Trustee of the California Institute of Technology.

Chang earned a B.S. in electrical engineering with highest honors from the University of Illinois and M.S. and Ph.D. degrees in EE from Caltech and he has completed the Harvard Owner President Management program. He received a Distinguished Alumni Award from Caltech in 2002, and was also named a Distinguished Alumnus by the University of Illinois. He is a Fellow of IEEE, Optical Society of America, and the Laser Institute of America (LIA), and past president of IEEE Photonics Society and LIA. He has also served on the Visiting Committee of the National Institute of Standards and Technology and the Committee on Harnessing Light: Capitalizing on Optical Science Trends and Challenges for Future Research, a report published by the National Research Council of the National Academies. Chang is a Member of the Committee of 100, an association of Chinese Americans who are leaders in their fields.

Dr Simon Poole
Sydney based Photonics Entrepreneur

Dr Simon Poole is an engineer/entrepreneur with over 30 years experience in photonics in research, academia and industry. He obtained his PhD from Southampton University and was a member of the team that invented the Erbium-Doped Fibe Amplifier (EDFA) in 1985.

After moving to Australia he founded the Optical Fiber Technology Centre (OFTC) and later directed the Australian Photonics Cooperative Research Centre (APCRC) node at the University of Sydney. The APCRC grew to over 150 researchers and led to 15 start-ups with over $250m in Venture Capital funding.

In 1995, Dr Poole led the first spin-off company from the APCRC, Indx Pty Ltd which manufactured Fiber Bragg Gratings for optical communications. Indx was acquired by Uniphase Corporation (now JDS Uniphase) and subsequently grew to over 300 people with exports of over $100m pa. He subsequently worked as a venture partner before co-founding Engana Pty Ltd in 2001. The company, now Finisar Australia, employs 280 people in Sydney and a similar number in China, with annual sales of Wavelength Selective Switches of >$100m pa.

In 2008, Dr Poole started the New Business Ventures Group within Finisar, using the principles of Open Innovation. The first business within this group was the WaveShaper range of Programmable Optical Processors with sales of over $6m pa.

Dr Poole is a Fellow of the IEEE and of the Institute of Engineers Australia. He has over 150 refereed papers and 7 patents.
Prof John Harvey

NZ based Entrepreneur and Physics Professor

John Harvey is a professor of Physics at the University of Auckland, and he is an internationally-recognised scientist in the fields of physics and optical communications. He is also the founder and Chief Executive Officer for Southern Photonics Ltd., an Auckland-based photonics company. Southern Photonics is the leading photonics technology company in New Zealand, specialising in Test and Measurement equipment in the fields of coherent modulation communication technologies and short laser pulse characterisation. Southern Photonics offers a complete range of equipment from signal generation to performance monitoring in these areas, and has recently developed strategic partnerships with a number of local and overseas companies.

John has received numerous professional honours during the course of his career. He is a Fellow of the New Zealand Institute of Physics, the Royal Society of New Zealand and the Optical Society of America.

A/Prof Jim Patrick

Senior Vice President, Chief Scientist, Cochlear Pty Ltd

DEng, BSc, MSc, FIIE Aust, CPE (Biomed), FTSE

A/Prof Jim Patrick is responsible for the global research portfolio of projects that feed into the commercial development stream. One of the original researchers involved with the cochlear implant program in Melbourne from 1975, Jim has worked in a number of senior managerial positions at Cochlear since its inception in 1981. Jim is an Associate Professor at the Department of Otolaryngology at The University of Melbourne and Adjunct Professor at La Trobe University.
Professor Elisabetta Barberio
University of Melbourne, Australia

Professor Elisabetta Barberio, a member of the Experimental Particle Physics Group at the University of Melbourne. She joined the University of Melbourne in 2004. Previously, she was a staff researcher at CERN, (CH), the European laboratory of Particle Physics. She played a crucial role in data analysis in the OPAL experiment at Large Electron Positron Collider at CERN. Precision measurements made at this collider have confirmed the theory describing the fundamental particle behaviour to an extraordinary degree of precision. She is currently participating in the e ATLAS experiment and her group had an important role in the discovery of the Higgs boson like-particle at the Large Hadron Collider.

Professor Gary Horowitz
University of California, USA

Professor Gary Horowitz is a Professor of Physics at the University of California, Santa Barbara. He received his B.A. at Princeton University in 1976 and Ph.D. at the University of Chicago in 1979. He was a postdoc at the Mathematical Institute, Oxford, and member of the Institute for Advanced Study, Princeton before moving to Santa Barbara.

Professor Horowitz is a member of the U.S. National Academy of Science, a fellow of the American Physical Society and member of the International Committee for the General Relativity and Gravitation Society. Professor Horowitz has written over 150 research articles, including the most cited particle physics paper in the 1980's.

Dr Thomas Mason
Oak Ridge National Laboratory, USA

Dr Thomas Mason is a native of Dartmouth, Nova Scotia, in Canada. He graduated from Dalhousie University in Halifax, Nova Scotia, with a Bachelor of Science degree in physics and completed his postgraduate study at McMaster University in Hamilton, Ontario, Canada, receiving a Doctor of Philosophy degree in experimental condensed matter physics.

After completing his Ph.D., he held a postdoctoral fellowship at AT&T Bell Laboratories in Murray Hill, New Jersey, and then became a Senior Scientist at Risø National Laboratory in Denmark. In 1993 he joined the faculty of the Department of Physics at the University of Toronto.

Dr Mason joined Oak Ridge National Laboratory (ORNL) in 1998 as Scientific Director for the U.S. Department of Energy’s Spallation Neutron Source (SNS) project. In April 2001 he was named Associate Laboratory Director for SNS and Vice President of UT-Battelle, LLC, which manages ORNL for the Department.

In 2006 he became Associate Laboratory Director for Neutron Sciences, leading a new organization charged with delivering safe and productive scientific facilities for studying the structure and dynamics of materials. In May 2007, he was named Director of ORNL and President and CEO of UT-Battelle.

Dr Mason’s research background is in the application of neutron scattering techniques to novel magnetic materials and superconductors using a variety of facilities in North America and Europe. As Director of the U.S. Department of Energy’s largest science and energy laboratory he has an interest in advancing materials, neutron, nuclear, and computational science to drive innovation and technical solutions relevant to energy and global security.

Dr Mason was named a Fellow of the American Association for the Advancement of Science in 2001, a Fellow of the American Physical Society in 2007, and a Fellow of the Neutron Scattering Society of America in 2010. He received the Distinguished Alumni Award for the Sciences from McMaster University in 2008 and the degree of Doctor of Laws, honoris causa, from Dalhousie University in May 2011.

Professor Petra Rudolf
University of Groningen, The Netherlands

Professor Petra Rudolf was born in Munich, Germany. She studied Physics at the La Sapienza, University of Rome, where she specialized in Solid State Physics. In 1987 she joined the National Surface Science laboratory TASC INFM in Trieste for the following five years, interrupted by two extended periods in 1989 and 1990/1991 at Bell Labs in the USA, where she started to work on the newly discovered fullerenes. In 1993 she moved to the University of Namur, Belgium where she received her PhD in 1995 and then quickly moved from postdoctoral researcher to lecturer and senior lecturer before taking up the Chair in Experimental Solid State Physics at the University in Groningen in 2003. Professor Rudolf was the President of the Belgian Physical Society in 2000/2001 and was elected fellow of the American Physical Society in 2010. Her principal research interests lie in the areas of condensed matter physics and surface science, particularly molecular motors, graphene, organic thin films and inorganic-organic hybrids.
Professor Brian Schmidt
Australian National University, Australia

Professor Brian Schmidt is a Laureate Fellow at The Australian National University’s Mount Stromlo Observatory. Professor Schmidt was raised in Montana and Alaska, USA, and received undergraduate degrees in Physics and Astronomy from the University of Arizona in 1989. Under the supervision of Robert Kirshner, he completed his Astronomy Master’s degree (1992) and PhD (1993) from Harvard University. In 1994 he and Nick Suntzeff formed the HighZ SN Search team, a group of 20 astronomers on 5 continents who used distant exploding stars to trace the expansion of the Universe back in time. This group’s discovery of an accelerating Universe was named Science Magazine’s Breakthrough of the Year for 1998. Professor Schmidt joined the staff of the Australian National University in 1995, and was awarded the Australian Government’s inaugural Malcolm McIntosh award for achievement in the Physical Sciences in 2000, The Australian Academy of Sciences Pawsey Medal in 2001, the Astronomical Society of India’s Vainu Bappu Medal in 2002, and an Australian Research Council Federation Fellowship in 2005. In 2006 Schmidt was jointly awarded the US$1M Shaw Prize for Astronomy, and shared the US$0.5M 2007 Gruber Prize for Cosmology with his High-Z SN Search Team colleagues. In 2008 he was elected a Fellow of the Australian Academy of Sciences, a Fellow of the United States National Academy, and Foreign Member of the Spanish Royal Academy of Sciences. His work on the accelerating universe was awarded the 2011 Nobel Prize in Physics, jointly with Adam Riess and Saul Perlmutter. Professor Schmidt is continuing his work using exploding stars to study the Universe, and is leading Mt Stromlo’s effort to build the SkyMapper telescope, a new facility that will provide a comprehensive digital map of the southern sky from ultraviolet through near infrared wavelengths.

Professor Bradley Sherrill
Michigan State University, USA

American Association for the Advancement of Science. He was elected and served as Chair of the Division of Nuclear Physics for the APS and serves on many international committees including the IUPAP and IUPAC task force for evaluation of claims for new elements. His research interests include nuclear astrophysics and isotope production and applications. He has nearly 200 refereed papers in journals including Nature, Science, and Physical Review Letters.

Professor Svein Sjøberg
University of Oslo, Norway

Professor Svein Sjøberg is Professor in science education at Oslo University and Copenhagen University. Educated as a nuclear physicist, later also in education (MA, Leeds University, dr. philos, Oslo University), Professor Sjøberg has been involved in curriculum reforms and the writing of textbooks for all levels, from primary school to University level. Professor Sjøberg has received many international prices for his research, teaching and public writing.

Current research interests include social, cultural and ethical aspects of science, science education in an international context, critical approach to issues of scientific literacy and public understanding of science. Professor Sjøberg is organiser of ROSE (The Relevance of Science Education), a cross-cultural comparative project on pupils’ interests, attitudes, perceptions etc. of importance to science teaching and learning.

Associate Professor Jelena Vuckovic
Stanford University, USA

Associate Professor Jelena Vuckovic received her PhD from California Institute of Technology (Caltech) in 2002, and has been on the faculty in the Electrical Engineering Department and Ginzton Laboratory at Stanford University since 2003. She is currently an Associate Professor and a Chambers Faculty Scholar at Stanford, and leads the Nanoscale and Quantum Photonics research group.

Associate Professor Vuckovic is a recipient of several awards, including the Humboldt Prize, the Presidential Early Career Award for Scientists and Engineers (PECASE) – the highest honor for young scientists in the U.S.A., the Office of Naval Research Young Investigator Award, and the DARPA Young Faculty Award.

Associate Professor Bradley Sherrill is Chief Scientist for the US Department of Energy Facility for Rare Isotope Beams. He is a fellow of the American Physical Society and the American Association for the Advancement of Science.

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Professor Jelena Vuckovic
### SUNDAY 9 DECEMBER 2012

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<th>1330-1900</th>
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| 1400-1700 | Industry Workshop  
|           | Connect your Research with Industry |
|           | **Room:** CLB 7  
|           | **Chair:** Benjamin J. Eggleton |
| Simon Poole | Sydney based Photonics Entrepreneur |
| John Harvey  | NZ based Entrepreneur and Physics Professor |
| Jim Patrick  | Cocklear |

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<tr>
<th>1700-1900</th>
<th>Welcome Reception and Exhibition Opening</th>
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### MONDAY 10 DECEMBER 2012

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<th>0730-1730</th>
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<tr>
<th>0800-1730</th>
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| 0830-0900 | Congress Opening  
|           | Her Excellency Professor Marie Bashir AC CVO, Governor of New South Wales |
|           | **Room:** Clancy Auditorium |

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<th>0900-1030</th>
<th>PLENARY 1 AND 2</th>
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| 0900-0945 | Plenary 1  
|           | **Room:** Clancy Auditorium  
|           | **Chair:** Adi Paterson  
|           | Science for the Energy Challenge  
|           | Thomas Mason  
|           | Oak Ridge National Laboratory |

| 0945-1030 | Plenary 2  
|           | **Room:** Clancy Auditorium  
|           | **Chair:** Hans Bachor  
|           | What Can We Learn – and Not Learn – From Comparative Studies of Educational Achievement in Science?  
|           | Svein Sjøberg  
|           | University of Oslo |

| 1030-1100 | Morning Tea – Exhibition and Poster Viewing  
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**CONCURRENT SESSION 1**

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<tr>
<th>Time</th>
<th>1A Optics, Photonics and Lasers: Nanofabrication</th>
<th>1B Condensed-Matter, Materials and Surface Physics 1: Graphene and Diamond</th>
<th>1C Quantum Information, Concepts and Coherence 1: Optical Quantum Information</th>
<th>1D Atomic and Molecular Physics 1: Anti-hydrogen / Positrons</th>
<th>1E Nuclear and Particle Physics 1</th>
<th>1F Biomedical Physics 1</th>
<th>1G ACOFT 1 Nonlinear Photonics</th>
<th>1H Plasma Physics</th>
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<tr>
<td>Chair: Heike Ebendorff-Heidepriem</td>
<td>Chair: Alex Hamilton</td>
<td>Chair: Andrew White</td>
<td>Chair: Michael Brungger</td>
<td>Chair: Kevin Varwel</td>
<td>Chair: Michael Lerch</td>
<td>Chair: Martijn de Sterke</td>
<td>Chair: Brian James</td>
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**1100-1130**  
Progress in Extreme Ultraviolet Lithography for IC Manufacturing  
William Arnold  
ASML Holding Inc.

**1130-1145**  
Adaptive Aberration Compensation for the Fabrication of Chalcogenide Gyroids  
Benjamin Cumming  
Swinburne University of Technology

**1145-1200**  
A Novel Hybrid Fabrication Approach for Three-dimensional Photonic Nanostructures  
Isabelle Staude  
Australian National University

**1200-1215**  
Alignment of Gold Nanorods by Photothermal Deposition, with Associated Single Particle Melting Studies  
Adam Taylor  
Swinburne University of Technology

**1215-1230**  
Unstable Digital Holographic Display in Nanoparticle-enabled Photorefractive Polymers  
Xiangping Li  
Swinburne University of Technology

**1230-1300**  
Lunch Break  
Please note lunch is not provided by the Congress  
Exhibition and Poster Viewing  
John Niland Scientia Building

**1300-1330**  
Bragg Gold Medal Winner: Studies of Universally in Strongly Interacting 6J Fermi Gases with Bragg Spectroscopy  
Eva Kuhnle  
Swinburne University of Technology
## MONDAY

### 1330-1500 CONCURRENT SESSION 2

<table>
<thead>
<tr>
<th>2A</th>
<th>Optics, Photonics and Lasers 2: Classical Optics: From Fundamentals to Fabrication</th>
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<tbody>
<tr>
<td>Room: CLB 7</td>
<td>Chair: Christopher Poulton</td>
</tr>
<tr>
<td>2B</td>
<td>Condensed-Matter, Materials and Surface Physics 2: Bulk Magnetism</td>
</tr>
<tr>
<td>Room: CLB 8</td>
<td>Chair: Glen Stewart</td>
</tr>
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<td>2C</td>
<td>Quantum Information, Concepts and Coherence 2: Optical Quantum Computing</td>
</tr>
<tr>
<td>Room: CLB 9</td>
<td>Chair: Geoff Pryde</td>
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<tr>
<td>2D</td>
<td>Atomic and Molecular Physics 2: Chemical Physics</td>
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<tr>
<td>Room: CLB 5</td>
<td>Chair: Jason Gascooke</td>
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<tr>
<td>2E</td>
<td>Nuclear and Particle Physics 2</td>
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<tr>
<td>Room: CLB 4</td>
<td>Chair: Andrew E. Stuchbery</td>
</tr>
<tr>
<td>2F</td>
<td>Biomedical Physics 2</td>
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<tr>
<td>Room: CLB 3</td>
<td>Chair: Scott Martin</td>
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<tr>
<td>2G</td>
<td>ACOTF 2 Photonic Crystal Fibres</td>
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<td>Room: CLB 2</td>
<td>Chair: Michel Digonnet</td>
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<tr>
<td>2H</td>
<td>Acoustic, Music and Ultrasonics and History of Physics</td>
</tr>
<tr>
<td>Room: CLB 1</td>
<td>Chair: Richard Newbury</td>
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<thead>
<tr>
<th>1330-1345</th>
<th>Silicon Photonics for Interconnects and Biotechnology</th>
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<tbody>
<tr>
<td>Room: CLB 7</td>
<td>Chair: Christopher Poulton</td>
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<tr>
<td>1345-1400</td>
<td>Designing Optically-Driven Microrobots for Maximum Torque Efficiency</td>
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<td>Room: CLB 8</td>
<td>Chair: Glen Stewart</td>
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<tr>
<th>1400-1415</th>
<th>In-band Localised Fano Surface States in Periodic Waveguiding Lattices</th>
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<tr>
<td>Room: CLB 9</td>
<td>Chair: Geoff Pryde</td>
</tr>
<tr>
<td>1415-1430</td>
<td>Helicity and Angular Momentum — Symmetry-based Study of Light-Matter Interactions</td>
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<tr>
<td>Room: CLB 5</td>
<td>Chair: Jason Gascooke</td>
</tr>
<tr>
<td>1430-1445</td>
<td>Helicity Conservation Rules for Designing Optimal Chiral Structures</td>
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<tr>
<td>Room: CLB 4</td>
<td>Chair: Andrew E. Stuchbery</td>
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<tr>
<td>1445-1500</td>
<td>Afternoon Tea – Exhibition and Poster Viewing</td>
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<td>Chair: Scott Martin</td>
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<tr>
<th>1500-1530</th>
<th>1530-1545 Afternoon Tea – Exhibition and Poster Viewing</th>
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<tr>
<td>Room: CLB 2</td>
<td>Chair: Michel Digonnet</td>
</tr>
<tr>
<td>1545-1600</td>
<td>Room: CLB 1</td>
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</table>

### 1500-1530 | Time-domain Biophotonics: Powering Next-generation Molecular Diagnostics |
| Room: CLB 7 | Chair: Christopher Poulton |

### 1615-1630 | The Magnetic Velcro Effect: Improved Model of Ferromagnet/Antiferromagnet Interfaces |
| Room: CLB 8 | Chair: Glen Stewart |

### 1630-1645 | Theory of an Atomic Bragg Interferometer |
| Room: CLB 9 | Chair: Geoff Pryde |

### 1645-1700 | Strong Chiral Optical Response from Planar Plasmonic Metamaterials |
| Room: CLB 5 | Chair: Jason Gascooke |

### 1700-1720 | Input Output Analysis of the Storage of Single Photons in Quantum Memories |
| Room: CLB 4 | Chair: Andrew E. Stuchbery |

### 1720-1740 | In Vivo Imaging of Nanodiamonds in Drosophila Melanogaster |
| Room: CLB 3 | Chair: Scott Martin |

### 1740-1750 | Gradient Echo Memory Using Cold Atoms |
| Room: CLB 2 | Chair: Michel Digonnet |

### 1750-1800 | Supersymmetric N=2 Gauge Theory and the Schwinger-Dyson Equations |
| Room: CLB 1 | Chair: Richard Newbury |

### 1800-1815 | Time-domain Biophotonics: Powering Next-generation Molecular Diagnostics |
| Room: CLB 7 | Chair: Christopher Poulton |

### 1815-1830 | Search for Xb decays to the Upsilon(1S) pi+ pi- final state using the ATLAS detector |
| Room: CLB 8 | Chair: Glen Stewart |

### 1830-1845 | Convergent Close-Coupling Method for Positron Scattering from Noble Gases |
| Room: CLB 9 | Chair: Geoff Pryde |

### 1845-1855 | Input Output Analysis of the Storage of Single Photons in Quantum Memories |
| Room: CLB 5 | Chair: Jason Gascooke |

### 1855-1910 | In Vivo Imaging of Nanodiamonds in Drosophila Melanogaster |
| Room: CLB 4 | Chair: Andrew E. Stuchbery |

### 1910-1920 | Gradient Echo Memory Using Cold Atoms |
| Room: CLB 3 | Chair: Scott Martin |

### 1920-1930 | Supersymmetric N=2 Gauge Theory and the Schwinger-Dyson Equations |
| Room: CLB 2 | Chair: Michel Digonnet |

### 1930-1945 | Time-domain Biophotonics: Powering Next-generation Molecular Diagnostics |
| Room: CLB 1 | Chair: Richard Newbury |
**CONCURRENT SESSION 3**

**Room: CLB 7**
- **Chair:** Michael Steel

**2A**
- **Optics, Photonics and Lasers 3: Metamaterials and Nanoresonators**
- **Abstract:** The Magnetic Velcro Effect: Improved Model of Ferromagnet/Anti-ferromagnet Interfaces
- **Speaker:** David Cortie
- **Institution:** Australian Nuclear Science and Technology Organisation

**2B**
- **Condensed-Matter, Materials and Surface Physics 3: Spintronics and Magnetic Films**
- **Abstract:** Benchmark Calculations of Electron and Positron Scattering on Atoms
- **Speaker:** Igor Bray
- **Institution:** Curtin University

**2C**
- **Quantum Information, Concepts and Coherence 3: Optical Quantum Memories**
- **Abstract:** The Belle II Experiment at the Super KEKb Accelerator
- **Speaker:** Martin Sevior
- **Institution:** University of Melbourne

**2D**
- **Atomic and Molecular Physics 3: Positron Scattering Theory**
- **Abstract:** Towards Simultaneous Brain PET Imaging and Behavioural Studies in Freely Moving Animals
- **Speaker:** Steve Meikle
- **Institution:** University of Sydney

**2E**
- **Nuclear and Particle Physics 3**
- **Abstract:** Monitoring of Plutonium and Uranium-236 in and around a Decommissioned Nuclear Power Plant in Italy Mario De Cesare
- **Institution:** Australian National University

**2F**
- **Biophysics 1**
- **Abstract:** Towards Multicore Fibre Bundle Fed Diffraction-Limited Spectrograph
- **Speaker:** Christopher Betters
- **Institution:** University of Sydney

**2G**
- **ACOFT 3 Photonic Devices 1**
- **Abstract:** Monitoring of Plutonium and Uranium-236 in and around a Decommissioned Nuclear Power Plant in Italy Mario De Cesare
- **Institution:** Australian National University

**3A**
- **Environmental Physics**
- **Abstract:** Monitoring of Plutonium and Uranium-236 in and around a Decommissioned Nuclear Power Plant in Italy Mario De Cesare
- **Institution:** Australian National University

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**Room: CLB 8**
- **Chair:** Jim Williams

**1530-1545**
- **Strong Chiral Optical Response from Planar Plasmonic Metamaterials**
- **Speaker:** Tim Davis
- **Institution:** CSIRO

**1545-1600**
- **Excitation of Single Multipolar Resonances**
- **Speaker:** Xavier Zambrana-Puyalito
- **Institution:** Macquarie University

**1600-1615**
- **Coulping Stabilisation of Microresonators**
- **Speaker:** Jong Chow
- **Institution:** Australian National University

**1615-1630**
- **Wideland Optical Activity in Coupled Chiral Meta Atoms**
- **Speaker:** Kirsy Hannam
- **Institution:** Australian National University

**1630-1645**
- **Biosensing with Microresonators using the Backscattered Light**
- **Speaker:** George Brawley
- **Institution:** University of Queensland

**1645-1700**
- **Multilayer FibreMelt Metal-Dielectric Structures as Magnetic Hyperbolic Metamaterials**
- **Speaker:** Sergey Kruk
- **Institution:** Australian National University

**1700-1830**
- **Poster Session 1**
- **Presenting authors to be available for discussion**
- **Refreshments provided**
- **Location:** John N lands Scientia Building

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**Room: CLB 6**
- **Chair:** Andrew Truscott

**Room: CLB 5**
- **Chair:** Dennis Mueller

**Room: CLB 4**
- **Chair:** Csaba Balazs

**Room: CLB 3**
- **Chair:** Roger Fulton

**Room: CLB 2**
- **Chair:** Sergio Leon-Saval

**Room: CLB 1**
- **Chair:** David Cohen

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**Room: CLB 7**
- **Room: CLB 8**
- **Room: CLB 6**
- **Room: CLB 5**
- **Room: CLB 4**
- **Room: CLB 3**
- **Room: CLB 2**
- **Room: CLB 1**
TUESDAY 11 DECEMBER 2012

0730-1730 Registration
John Niland Scientia Building

0800-1730 Exhibition Open
John Niland Scientia Building

0900-1030 PLENARY 3 AND 4

0900-0945 Plenary 3
Room: CLB 7
Chair: Ben Eggleton
Quantum Dots in Optical Nanocavities: from Cavity QED to Device Applications
Jelena Vuckovic
Stanford University

0945-1030 Plenary 4
Room: CLB 7
Chair: David J. Hinde
Search for the Origin and Stability of the Elements
Bradley Sherrill
University of Michigan

1030-1100 Morning Tea – Exhibition Viewing
John Niland Scientia Building

1100-1230 CONCURRENT SESSION 4

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<thead>
<tr>
<th>Room: CLB 7</th>
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<th>Room: CLB 5</th>
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<th>Room: CLB 3</th>
<th>Room: CLB 2</th>
<th>Room: CLB 1</th>
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<tbody>
<tr>
<td>Chair: David Spence</td>
<td>Chair: Anita Hill</td>
<td>Chair: Michael Tobar and Daniel Creedon</td>
<td>Chair: Charles Clark</td>
<td>Chair: Gregory Lane</td>
<td>Chair: Jamie Vandenberg</td>
<td>Chair: Andrew Ellis</td>
<td>Chair: Cathy Foley</td>
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</table>

1100-1115 Phase-matched Generation of High Order Harmonics Radiation and Application
Lap Van Dao
Swinburne University of Technology

1115-1130 Molecular Dynamics Study of the Evolution of Topology in Nanoporous Metal Sponges
Michael Cortie
University of Technology Sydney

1130-1145 Resolving the Orientation and Morphology of Ultra-Fine Precipitates Using Atomic-Force Microscopy
Andrew Breen
University of Sydney

1145-1200 Parametric Down-conversion of Microwave Photons Using Superconducting Quantum Devices
Timothy Duty
University of New South Wales

1200-1215 A Neutral Mercury Optical Boson Search in the H+ – WW Decay Mode in ATLAS
John McFerran
University of Western Australia

1215-1230 Unfolding Single Biomolecules
Erik Streed
Griffith University

1230-1330 Lunch Break

Please note lunch is not provided by the Congress

1330-1345 From Boolardy to Brisbane: Accurate Time and Frequency for the Nation
Andre Luiten
University of Western Australia

1345-1400 Tuning Research into Industries: Reflections from Both Sides of the Fence
Maryanne Large
CSIRO
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Speaker</th>
<th>Institution</th>
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<tr>
<td>1145-1200</td>
<td>Frequency Locking of a 369nm Laser by Nonlinear Spectroscopy of Ytterbium Ions in a Discharge</td>
<td>Michael Lee</td>
<td>University of Sydney</td>
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<td>1145-1200</td>
<td>Structural Health Monitoring of Space Vehicle Thermal Protection Systems: Material Properties</td>
<td>Don Price</td>
<td>CSIRO</td>
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<tr>
<td>1145-1200</td>
<td>Superconducting Resonators with Parasitic Electromagnetic Environments</td>
<td>John Hornibrook</td>
<td>University of Sydney</td>
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<tr>
<td>1145-1200</td>
<td>Microwave Field Imaging Using Atoms</td>
<td>Andrew Horsley</td>
<td>University of Basel</td>
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<tr>
<td>1145-1200</td>
<td>The Pair Decay of the 7.654 MeV State in $^{13}$C</td>
<td>Tibor Kibedi</td>
<td>Australian National University</td>
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<tr>
<td>1145-1200</td>
<td>PH Gradient Electrofocusing for Proteomics</td>
<td>Michael Startsev</td>
<td>Macquarie University</td>
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<tr>
<td>1200-1215</td>
<td>A Novel High-power, Frequency-stabilised Solid-state 313 nm Laser Systems for ‘Br’ ion Trapping</td>
<td>Harrison Ball</td>
<td>University of Sydney</td>
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<tr>
<td>1200-1215</td>
<td>Stresses in Inclusions Resulting from Plastic Flow in the Matrix of a Two-Phase Composite Due to Cyclic Loading</td>
<td>Trevor Finlayson</td>
<td>University of Melbourne</td>
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<tr>
<td>1200-1215</td>
<td>Delocalised Oxygen as the Origin Of Strongly Coupled Two-level Defects in Josephson Junctions</td>
<td>Timothy Dubois</td>
<td>RMIT University</td>
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<tr>
<td>1200-1215</td>
<td>Precise Manipulation of a Bose-Einstein Condensate’s Wavefunction</td>
<td>Stuart Szegi</td>
<td>Australian National University</td>
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<td>1200-1215</td>
<td>Testing the Standard Model of Particle Physics at Parts in $10^{-10}$, Using Rotating Cryogenic Sapphire Oscillators</td>
<td>Michael Tobar</td>
<td>University of Western Australia</td>
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<td>1200-1215</td>
<td>Mechanism of Infrared Neural Stimulation of Murine Auditory Neurons in Vitro</td>
<td>Daniel Shaddock</td>
<td>Australian National University</td>
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<tr>
<td>1200-1215</td>
<td>Fibre Sensing Techniques Adapted from Gravitational Wave Detection</td>
<td>Warren McKenzie</td>
<td>Australian National Fabrication Facility</td>
</tr>
<tr>
<td>1215-1230</td>
<td>Generation of Spiral Beams With Multimode Optical Fibres</td>
<td>David Coutts</td>
<td>Macquarie University</td>
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<tr>
<td>1215-1230</td>
<td>Metastable Behavior at Very High Temperature</td>
<td>Klaus-Dieter Liss</td>
<td>Australian Nuclear Science and Technology Organisation</td>
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<tr>
<td>1215-1230</td>
<td>Behaviour of the Fe3+ Paramagnetic Ion in Sapphire Whispering Gallery Mode Resonator at mK Temperatures Under DC Magnetic Field</td>
<td>Warrick Farr</td>
<td>University of Western Australia</td>
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<td>1215-1230</td>
<td>Coherent Tunneling via Adiabatic Passage in a Three-Well Bose-Hubbard System</td>
<td>Chris Bradly</td>
<td>University of Melbourne</td>
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<tr>
<td>1215-1230</td>
<td>Time-Dependent Recoil in Vacuum – Improved Sensitivity to Hyperfine Fields and Nuclear Moments</td>
<td>Asif Ahmed</td>
<td>Australian National University</td>
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<td>1215-1230</td>
<td>Methodology to Measure the Electrical Conductivity of Seizing and Non-Seizing Mouse Brain Slices</td>
<td>Maher Elbouhaly</td>
<td>University of Waikato</td>
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<tr>
<td>1230-1230</td>
<td>Lunch Break</td>
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<td>1230-1230</td>
<td>Please note lunch is not provided by the Congress</td>
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<td>1235-1320</td>
<td>Plenary Discussion</td>
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<td>1235-1320</td>
<td>Physics Decadal Plan led by David Jamieson</td>
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<tr>
<td>Time</td>
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<td>1330</td>
<td>5A</td>
<td>Optical, Photonics and Lasers 5: Lasers 2 and Laser Applications</td>
<td>Lap van Dae</td>
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<td>1330</td>
<td>5B</td>
<td>Condensed-Matter, Materials and Surface Physics 5: Optical and Meta-materials</td>
<td>Olivia Samardzic</td>
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<tr>
<td>1330</td>
<td>5C</td>
<td>Quantum Information, Concepts and Coherence 5: Quantum Information Theory</td>
<td>Stephen Bartlett</td>
</tr>
<tr>
<td>1330</td>
<td>5D</td>
<td>Atomic and Molecular Physics 5: Scattering Dynamics</td>
<td>Igor Bray</td>
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<tr>
<td>1330</td>
<td>5E</td>
<td>Nuclear and Particle Physics 5</td>
<td>Martin Sivori</td>
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<td>1330</td>
<td>5F</td>
<td>Biophysics 3</td>
<td>Martin Carolan</td>
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<td>1330</td>
<td>5G</td>
<td>ACOFT 5 Photonic Sensing 1</td>
<td>David Sampson</td>
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**1330-1345**

**Concurrent Session 5**

**5A**

- **Light-Tunable Metamaterial Mirror**
  - Bya Shadrivov
  - Australian National University

**5B**

- **New Physics in Two Dimensions: Braiding Interactions of Anyons**
  - Gavin Brennen
  - Macquarie University

- **Topological Phase in Spin Polarised Electron Exchange Excitation of an Atom**
  - Jim Williams
  - University of Western Australia

**5C**

- **Theoretical Implications of the LHC Resonance at 125-126 GeV**
  - Archil Kobakhidze
  - University of Sydney

- **Potential Treatment of Radioresistant Tumours Using Synchrotron Generated X-Ray Microbeams**
  - Michael Lerch
  - University of Wollongong

**5D**

- **Simulated Diffusion Tensor of Water in Fiber Networks with Distributions of Fiber Alignment**
  - Prasanga Palihawadana
  - Australian National University

**5E**

- **Sub-Picosecond Sensors Using Slow Light in Fiber Bragg Gratings**
  - Michel Digonnet
  - Stanford University

**5F**

- **A Low Profile Fibre Optic Pressure Sensing Tape for Monitoring Pressures Under a Compression Bandage**
  - Courtney Brell
  - University of Technology Sydney

- **Electronic and Positron Scattering from Pyrimidine Compared with Other Biological Analogs**
  - Low Depth Quantum Circuits for Ising Models
  - Muaro Cirio
  - Macquarie University

- **Electron and Positron Scattering from Molecular Hydrogen**
  - Jaiswal Baldev
  - University of Melbourne

- **Neutrons Outgrowth in Proteins and Other Glasses**
  - Brendan Kennedy
  - University of Western Australia

- **A Low Profile Fibre Optic Force Sensing Tape for Monitoring Pressures Under a Compression Bandage**
  - John Arkwright
  - CSIR

**5G**

- **1445-1500**

**1500-1530**

- **Afternoon Tea – Exhibition and Poster Viewing**
  - John Niland Scienctia Building
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<tr>
<th>Time</th>
<th>Session Title</th>
<th>Speaker(s)</th>
<th>Institution(s)</th>
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<tr>
<td>1530-1700</td>
<td><strong>CONCURRENT SESSION 6</strong></td>
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<tr>
<td>1530-1545</td>
<td>Quantum Technology for a Networked World</td>
<td>Peter Knight</td>
<td>Imperial College London</td>
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<tr>
<td>1545-1600</td>
<td>University of the Heisenberg Limit</td>
<td>Dominique Berry</td>
<td>Macquarie University</td>
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<tr>
<td>1600-1615</td>
<td>Direct Characterisation of a Linear Optical Network</td>
<td>Matthew Broome</td>
<td>University of Queensland</td>
</tr>
<tr>
<td>1615-1630</td>
<td>Position Annihilation and Electron Microscopy of Off-Stoichiometric Zn,TiO3_2</td>
<td>Idaho Falls</td>
<td>Australian Nuclear Science and Technology Organization</td>
</tr>
<tr>
<td>1630-1645</td>
<td>Position Annihilation Studies of Materials</td>
<td>Paul Guagliardo</td>
<td>University of Western Australia</td>
</tr>
<tr>
<td>1645-1700</td>
<td>Comparative X-ray and Raman Study of Cellulose Texture and Nanostructure in Wood</td>
<td>Chris Garvey</td>
<td>Australian Nuclear Science and Technology Organization</td>
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<tr>
<td>1700-1830</td>
<td>Post-deadline session for AOS and ACOFT</td>
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<td>1900-2300</td>
<td>Congress Dinner</td>
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### WEDNESDAY 12 DECEMBER 2012

<table>
<thead>
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<tbody>
<tr>
<td>0730-1730</td>
<td>Registration</td>
</tr>
<tr>
<td>0800-1730</td>
<td>Exhibition Open</td>
</tr>
<tr>
<td>0900-1030</td>
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<td>Molecular Motors and Switches at Surfaces</td>
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<td>Petra Rudolf</td>
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<tr>
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<td>Surprising Connections between Gravity and Condensed Matter</td>
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<td>Gary Horowitz</td>
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<td>University of California Santa Barbara</td>
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<td>7A</td>
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<td>7C</td>
<td>Quantum Information, Concepts and Coherence 7: Frontiers in Quantum</td>
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<tr>
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<tr>
<td>7H</td>
<td>Joint: Optics, Photonics and Lasers + Condensed-Matter, Materials and</td>
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<td>Transformation Media in Space and Time: Causality, Dickies, and Curve</td>
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<td>1130-1145</td>
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<td>1145-1200</td>
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<td>Room: CLB 7</td>
<td>Chair: Oleg Sushkov</td>
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**7D Atomic and Molecular Physics 7: Matter Interactions**
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**7E Solar, Terrestrial and Space Physics 2**
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**7F Rheology 2**
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**Transformation Media in Space and Time: Causality, Dickies, and Curve**
- Paul Kinsler
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**Magnetic Quasi-crystal Metamaterials**
- Dragomir Neshev
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**Magnetic Quasi-crystal Metamaterials**
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Kokou Dossou  
University of Technology, Sydney |
| 1145-1200 | Structure Evolution and Spin Dynamics of Highly Co-doped Spin Ladder Superconductor Sr2CoCu2O7  
Guochu Deng  
Australian Nuclear Science and Technology Organisation |
| 1145-1200 | Biological Measurement Beyond the Quantum Limit  
Michael Taylor  
University of Queensland |
| 1145-1200 | Nonequilibrium Modelling of Atomic and Molecular Processes in Planetary Atmospheres  
Laurence Campbell  
Flinders University |
| 1145-1200 | Wavelength Matched Etalons for the Solar Orbiter Polariometric and Helioseismic Imager  
David Farrant  
CSIRO |
| 1145-1200 | Spin and Linear Momentum Coupling: Generating Steady-State Flow Without Mechanical Pumping at the Alnoscale  
Sergio De Luca  
Swinburne University of Technology |
| 1145-1200 | Splice-Free DFB Fibre Laser Array  
Alexei Tikhomirov  
Defence Science and Technology Organisation |
| 1200-1215 | Photoluminescence Enhancement in Magnetic Quantum-dot Metamaterials  
Manuel Decker  
Australian National University |
| 1200-1215 | Quantum Noise in a SQUID-Tunable Microchip Resonator  
Yurema Reshniky  
University of Queensland |
| 1200-1215 | Results from the LIGO Squeezed Light Injection Experiment  
Sheon Chua  
Australian National University |
| 1200-1215 | Two-Centre Convergent Close-Coupling Calculations of Positron Scattering from Magnesium  
Ravshanbek Utamuratov  
Curtin University |
| 1200-1215 | The Australian Empirical Real Time Regional Ionosphere Model  
Matt Francis  
IPS Radio and Space Services |
| 1200-1215 | A Hyperelastic Constitutive Approach for the Rheology of Concentrated Particulate Suspensions under Combined Shear and Compression Loads  
Anthony Slickland  
University of Melbourne |
| 1200-1215 | Single-Polarisation DFB Fibre Laser in Photosensitive Ho-doped Fibre  
Michael Derrmann  
Defence Science and Technology Organisation |
| 1215-1230 | Practical Superconductors: Measurements and Reality  
Alexey Pan  
University of Wollongong |
| 1215-1230 | Discretely Observable 3D Quantum Walk Structures  
Michael Steel  
Macquarie University |
| 1215-1230 | Positron Scattering From Ethene  
Luca Chiari  
Flinders University |
| 1215-1230 | Significant Events to Date in Cycle 24  
Dave Neudegg  
Bureau of Meteorology |
| 1215-1230 | Role of Self-Concentration and Coil-Stretch Hysteresis in Electrospinning of Nominally Dilute Polymer Solutions  
Ranganathan Prabhatkar  
Monash University |
| 1220-1250 | 2012 AOS W.H. (Beatlie) Steel Medal Winner: Nonlinear Optics: Starting and Finishing in the Mid Infrared  
Barry Luther-Davies  
Australian National University |
| 1220-1250 | Female Participation in Tertiary Physics: What's the Status of Women in Physics in Australia and What Are the Issues Right Now?  
Cathy Foley  
CSIRO |
| 1220-1250 | The Role of Women Academics in Australian Universities  
Susan Peters  
Deakin University |
| 1220-1250 | Female Participation in Tertiary Physics: What's the Status of Women in Physics in Australia and What Are the Issues Right Now?  
Juna Sathian  
Queensland University of Technology |
| 1230-1330 | Lunch Break  
Please note lunch is not provided by the Congress |
| 1230-1330 | Exhibition and Poster Viewing  
John Niland Scientia Building |
| 1235-1320 | Women in Physics Session  
Room: CLB 6  
What is the Real Status of Women in Physics in Australia and What Are the Issues Right Now?  
Cathy Foley  
CSIRO |
| 1235-1320 | The Role of Women Academics in Australian Universities  
Susan Peters  
Deakin University |
| 1235-1320 | Female Participation in Tertiary Physics: What's the Status of Women in Physics in Australia and What Are the Issues Right Now?  
Juna Sathian  
Queensland University of Technology |
### 1330-1500 CONCURRENT SESSION 8

#### 1330-1345
- **Room: CLB 7**
  - Shaping and Twisting Light Beams Using Nonlinear Photonic Crystals
  - **Ady Arie**
  - Tel Aviv University

- **Room: CLB 8**
  - Quantum Computing in Silicon with Donor Electron Spin
  - **Michelle Simmons**
  - University of New South Wales

- **Room: CLB 6**
  - Quantum Optoelectronics for Sensing and Fundamental Science
  - **Warwick Bowen**
  - University of Queensland

- **Room: CLB 5**
  - Electron Scattering Phenomena from Radicals of Technological Interest
  - **Darryl Jones**
  - Flinders University

- **Room: CLB 4**
  - The Australian Square Kilometre Array Pathfinder
  - **Lisa Harvey-Smith**
  - CSIRO

- **Room: CLB 2**
  - Physical Principles Underlying Complex Brain Network Organisation
  - **Peter Robinson**
  - University of Sydney

- **Room: CLB 1**
  - Ultrastiff Laser Inscription of Integrated "Photonic Lanterns"
  - **Robert Thomson**
  - Heriot-Watt University

#### 1345-1400
- **Room: CLB 7**
  - Randomly Poled Lithium Niobate Crystal for Broadband Optical Frequency Conversion
  - **Yan Sheng**
  - Australian National University

- **Room: CLB 8**
  - Nuclear Magnetic Resonance and Hyperfine Coupling in GaAs Electron and Hole Quantum Wires
  - **Alex Hamilton**
  - University of New South Wales

- **Room: CLB 6**
  - Vibration Stabilisation for Quantum Optomechanics
  - **David McAslan**
  - University of Queensland

- **Room: CLB 5**
  - RF-induced Feedback Resonances in Rb-87
  - **Mikhail Egorov**
  - Monash University

- **Room: CLB 4**
  - The H.E.S.S. II Gamma-Ray Telescope – A New Window onto the GeV Gamma-Ray Sky
  - **Gavin Rowell**
  - University of Adelaide

- **Room: CLB 2**
  - Blow-Up Phenomenon For Evolutionary Inequities with Singularities on Unbounded Sets
  - **Evgeny Galakhov and Olga Safieva**
  - Russian Peoples’ Friendship University

- **Room: CLB 1**
  - Nanophotonic Phase Modulator
  - **Unnithan**
  - University of Melbourne

#### 1400-1415
- **Room: CLB 7**
  - Phase-sensitive Amplification by Four-Wave-Mixing on a Chalcogenide Waveguide
  - **Richard Neo**
  - University of Sydney

- **Room: CLB 8**
  - Fabrication and Characterisation of Ambipolar AlGaAs/GaAs Heterostructure Devices
  - **Daisy Wang**
  - University of New South Wales

- **Room: CLB 6**
  - Enhanced Micromechanical Sensors: Active Feedback vs Optimal Postprocessing
  - **Glen Harris**
  - University of Queensland

- **Room: CLB 5**
  - The Role of Spin in Triplet-Triplet Upconversion
  - **Andrew Danos**
  - University of Sydney

- **Room: CLB 4**
  - Redisign of the Integrated Photonic Spectrograph for Improved Astronomical Performance
  - **Nick Cvetkovic**
  - Macquarie University

- **Room: CLB 2**
  - New Applications of Sparse Methods in Physics
  - **Ra Inta**
  - Australian National University

- **Room: CLB 1**
  - Modifying the Contact Angle Of Glass Substrates with Laser Irradiation for Self-Assembly of Photonic Microwave Waveguides
  - **Masood Naqshbandi**
  - University of Melbourne

#### 1415-1430
- **Room: CLB 7**
  - Controlable Photon-Pair Generation and Quantum Walks in Nonlinear Waveguide Arrays
  - **Andrey Sukhorukov**
  - Australian National University

- **Room: CLB 8**
  - A New Crystalline Phase of Silicon Formed from Indentation-Induced High-Pressure Phases
  - **Bianca Haberl**
  - Australian National University

- **Room: CLB 6**
  - Phonon Number Measurements Using Single Photon Opto-Mechanics
  - **Sahar Basiri-Esfahani**
  - University of Queensland

- **Room: CLB 5**
  - Three-atom Collisions in a Dilute Thermal Vapour
  - **Tom Stace**
  - University of Queensland

- **Room: CLB 4**
  - Laser Tomography Adaptive Optics System for the Giant Magellan Telescope
  - **Francis Bennet**
  - Australian National University

- **Room: CLB 2**
  - Design for Broadband On-Chip Isolator Using Stimulated Brillouin Scattering
  - **Christopher Poulton**
  - University of Technology Sydney

- **Room: CLB 1**
  - Broadband Unidirectional Yagi-Uda Nanocantennas
  - **Isabelle Staude**
  - Australian National University

#### 1430-1445
- **Room: CLB 7**
  - The 1D g-factor and 0.7 Anomaly in QPCs with Independent Control Over Density
  - **Adam Burke**
  - University of New South Wales

- **Room: CLB 8**
  - Two Photon Conditional Optomechanics
  - **Uzma Akram**
  - Griffith University

- **Room: CLB 6**
  - Dynamics and Control of Electron Localisation in Dissociating Molecules
  - **Igor Litvinyuk**
  - Griffith University

- **Room: CLB 5**
  - Phasing Concept for Segmented Mirror Telescopes Using Digital Interferometry
  - **Silvie Ngo**
  - Australian National University

- **Room: CLB 4**
  - Relative Intensity Noise of Yb-DFB Waveguide Laser Fabricated Using Femtosecond Laser Direct-write Technique
  - **Yuwen Duan**
  - Macquarie University

- **Room: CLB 2**
  - Tuning Photoabsorption for Ultra-High Resolution Nanofabrication with Metals
  - **Yaoyu Cao**
  - Swinburne University of Technology

- **Room: CLB 1**
  - Australian Contributions to the GRACE Follow-On Satellite Mission
  - **Tel Aviv University**

#### 1445-1500
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  - **Tel Aviv University**

### 1500-1530
- **Room: CLB 7**
  - Afternoon Tea – Exhibition and Poster Viewing
  - **John Niland**
  - Swinburne University of Technology
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<td>Tackable On-chip Stimulated Brillouin Scattering in Nanoscale Silicon Waveguides</td>
<td>David Jamieson</td>
<td>Room: CLB 7</td>
<td>Ab initio Calculation of SLP Nanowires Confined Atomically in Two Dimensions Daniel Drumm RMIT University</td>
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<td>Realising Lateral Wrap-gated Nanowire FETs and Controlling Gate Length with Chemistry Adam Micolich University of New South Wales</td>
<td>David Jamieson</td>
<td>Room: CLB 7</td>
<td>Quantum Control in Foundational Experiments Daniel Terno Macquarie University</td>
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<td>1600-1615</td>
<td>Transformation of Higher-order Spatial Solitons in Nematic Liquid Crystals Yana Izdebskaya Australian National University</td>
<td>David Jamieson</td>
<td>Room: CLB 7</td>
<td>Influence of Strain to the Electron-phonon Coupling in Degenerately Doped Silicon at Low Temperatures Juhu Muohon University of New South Wales</td>
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<td>1615-1630</td>
<td>Nonlinear Conical Diffraction in Photonic Liquid Lattices Daniel Leykam Australian National University</td>
<td>David Jamieson</td>
<td>Room: CLB 7</td>
<td>Measuring the Hardness of Silicon Jody Bradby Australian National University</td>
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<td>Signatures of Integrability Breaking Via Dark-Bright Soliton Collisions in a Two-Component Bose-Einstein Condensate</td>
<td>David Jamieson</td>
<td>Room: CLB 7</td>
<td>Structural Relaxation of Ion-implanted Amorphous Silicon Leonardo Bimo Bayu Aji Australian National University</td>
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<td>High-pressure Phase Transformations by Fs-laser in Transparent and Opague Media Eugene Gamaly Australian National University</td>
<td>David Jamieson</td>
<td>Room: CLB 7</td>
<td>Single keV Ion Detection in Silicon Changyi Yang University of Melbourne</td>
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<td>Type Ia Supernovae, the Accelerating Cosmos and Dark Energy</td>
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<td>Brian Schmidt</td>
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<td>Discovery of the Higgs Boson</td>
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<td>1100-1230</td>
<td><strong>Concurrent Session 10</strong></td>
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<tr>
<td>10A</td>
<td><strong>Optics, Photonics and Lasers 10: Plasmonics 2</strong></td>
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<td>Chair: Isabelle Staude</td>
<td>Chair: Ron White</td>
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<td>10B</td>
<td><strong>Condensed-Matter, Materials and Surface Physics 10: Semiconductors-III</strong></td>
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<td>Chair: Jason Twamley</td>
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<td>10C</td>
<td><strong>Quantum Information, Concepts and Coherence 10: Spins in Solids</strong></td>
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<td>Chair: Susan Scott</td>
<td>Chair: Shane Kennedy</td>
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<td>Chair: Simon Fleming</td>
<td>Chair: Maryanne Large</td>
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<td><strong>Relativity and Gravitation 1</strong></td>
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<td>10F</td>
<td><strong>Condensed-Matter, Materials and Surface Physics 13: Instruments and Methods</strong></td>
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<td><strong>Optics, Photonics and Lasers 15: Spectroscopy</strong></td>
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<td>1100-1115</td>
<td><strong>Fluorescent Nanoparticles for Advanced Bioimaging and Biosensing</strong></td>
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<td><strong>Transport and Recombination in Disordered Organic Semiconductors</strong></td>
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<td><strong>Diamond Based Quantum Technologies</strong></td>
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<td><strong>Gravitational Wave Detection Using Laser Interferometry</strong></td>
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<td>1115-1130</td>
<td><strong>An Ultra-stable Atomic Force Microscope with Integrated Laser Interferometry</strong></td>
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<td>1115-1130</td>
<td><strong>Current Trends in Optical Communications</strong></td>
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<td><strong>High Accuracy Absorption Spectroscopy at the Shot-Noise Limit</strong></td>
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<td>1130-1145</td>
<td>Collision of Non-diffracting Any Surface Plasmons</td>
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<td>A Spin-based Organic Magnetic Field Sensor</td>
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<td>A New Optically-Addressable Spin Qubit in Diamond</td>
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<td>The Impact of Values and Self-Identity on University Physics Learning</td>
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<td>Photons, Qubits and Satellite Experiments</td>
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<td>Broadband RF Phase Shifting with a Simple Fibre Interferometer</td>
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<td>Applications of Two-Photon Spectroscopy of Rubidium Within Hollow-Core Optical Fibre</td>
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<td>1145-1200</td>
<td>Plasmonic Whispering Gallery Mode Biosensors</td>
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<td>Annealing Study of Ion Implanted Diamond</td>
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<td>Scalable Patterned Nanodiamond Arrays</td>
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<td>Comparison of Two Physics Honours Seminar Assessment Strategies</td>
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<td>Gravitational Entropy within the Quiescent Cosmology Framework</td>
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<td>Plane-Based Lattice Rectification of Icp Crystals</td>
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<td>Simple Frequency Shift Keyed Radio-Over-Fibre Communication System</td>
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<td>Mid-infrared Femtosecond Spectroscopy for Broadband and Rapid Greenhouse Gas Characterisation</td>
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<td>1200-1215</td>
<td>Efficient Control of Polarisation-Entangled Photons Pairs with Plasmonic Nanocantennas</td>
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<td>Is Thermal Annealing a Viable Alternative for Crystalization in Triethylene Glycol Organic Transistors?</td>
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<td>Slow Hopping of Polaron Pairs in MEH-PPV</td>
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<td>Improving Student Engagement and Outcomes in Level I Physics</td>
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<td>Cathodoluminescence Characterisation of Point Defects in GaN Nanomembranes</td>
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<td>Reconfigurable Remote Nodes in 60 GHz Radio-over-Fiber Networks</td>
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<td>Trace-level Sensing of Greenhouse Gases by Continuous-wave Cavity-ringdown Spectroscopy</td>
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<td>Plasmonic Cross-slot Antennas</td>
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<td>Fractional Kinetics in Phase and Configuration Space</td>
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<td>Diamond IV/ Spin Qubits for Sensing in Biology</td>
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<td>How a Physics Degree Changes Students’ Attitudes and Learning Behaviours</td>
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<td>Narrow Resonances and Black-Hole-Like Absorption in a Non-Black-Hole Metric</td>
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<td>Phonons Observed by Laser Diffraction on a Continuous Neutron Source</td>
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<td>Three-Cone Weakly-Guiding Mode-Sensitive Fibre Couplers</td>
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<td>Levitation of Particles in Air</td>
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<td>Measurement of Macroparticle</td>
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### 1500-1530
Afternoon Tea and Exhibition Viewing
John Niland Scientia Building

### 1530-1630
**CONCURRENT SESSION 12**

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<th>Session</th>
<th>Chair(s)</th>
<th>Location</th>
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<tr>
<td>1530-1545</td>
<td>Exploiting the Symmetries of Nanostructures for Metrology Applications</td>
<td>Nora Tischler, Macquarie University</td>
<td>Room: CLB 7</td>
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<tr>
<td>1545-1600</td>
<td>Digitally Enhanced Homodyne Interferometry for Multiplexed, Picoemitter Sensitive Metrology</td>
<td>Andrew Sutton, Australian National University</td>
<td>Room: CLB 8</td>
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<td>1600-1615</td>
<td>Ultrasensitive Cavity Optomechanical Magnetometry</td>
<td>Stefan Forstner, University of Queensland</td>
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<td>1615-1630</td>
<td>High-speed, 3D Tracking of Colloidal Systems Using Digital Holographic Microscopy</td>
<td>Anna Wang, Harvard University</td>
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### THURSDAY

#### Room: CLB 7

- **12A** Optics, Photonics and Lasers 12: Nanometrology
- **12B** Condensed-Matter, Materials and Surface Physics 12: Spin Chains, Spin Ladders and Spin Ice
- **12C** Quantum Information, Concepts and Coherence 13: Cold Atoms 2
- **12D** Quantum Information, Concepts and Coherence 12: Trapped Ions
- **12E** Relativity and Gravitation 3
- **12F** Energy, Energy Materials and Energy Systems
- **12G** ACOFT 12 Chalcogenide Waveguides
- **12H** Optics, Photonics and Lasers 17: Novel Techniques in Optical Measurement

#### Chair(s):
- **12A** Manuel Deker
- **12B** Chris Hamer
- **12C** Matthew Davis
- **12D** David Reilly
- **12E** John Steele
- **12F** Matthew Hole
- **12G** Tanya Morone
- **12H** Stefania Castelletto

#### Abstracts

- **12A**
  - **Optics and Lasers 12:**
    - Ice Rule Coherence in Stuffed Spin Ice
      - Bob Aldus, Australian Nuclear Science and Technology Organisation
    - Precision Measurement of S-wave Scattering Lengths
      - Mikhail Egorev, Monash University
    - Field Control to Quantum Simulation with Trapped Ions
      - Michael Biercuk, University of Sydney
    - Balanced Electric-Magnetic Dipole in Kaluza-Klein Theory
      - Edward Teo, Australian National University
    - Multiscale Structure and Energetics in Photosynthetic Solar Energy Harvesting
      - Andrew Ringsmuth, University of Queensland
    - Intensity-Dependent Photoabsorbency of Chalcogenide As$_2$S$_3$ Fibers
      - Irina Kabakova, University of Sydney

- **12B**
  - **Condensed-Matter, Materials and Surface Physics 12:**
    - Thermodynamic Properties of an Anisotropic Heisenberg Model for the XY Pyrochlore
      - Peter Drummond, Swinburne University of Technology
    - Entanglement and Optimised Interferometric Phase Measurement in BECs
      - Yinan Zhang, Swinburne University
    - The Standard Chart Based Approach to Studying the Global Structure of a Spacetime Induces a Coordinate Invariant Boundary of Ideal Points
      - Ben Whale, University of Otago
    - Broadband Absorption Enhancement in Ultra-thin Crystalline Si Solar Cells by a Sandwich Photonic-Plasmonic Structure
      - Yinan Zhang, Swinburne University
    - Stimulated Brillouin Scattering and Bragg Grating Formation in As$_2$S$_3$ Fiber
      - Irina Kabakova, University of Sydney
    - Characterisation of Nanodiamond-dispersed Photopolymers Towards High-density Optical Data Storage
      - Jelle Storteboom, Swinburne University of Technology

- **12C**
  - **Quantum Information, Concepts and Coherence 13:**
    - The Complex Magnetic Phase Diagram of the Quantum Spin Chain Material, Linarite, PbCuSO$_4$OH
      - Kirrily Rule, Australian Nuclear Science and Technology Organisation
    - Exact Quench Dynamics of the One-Dimensional Bose Gas Using the Lieb-Liniger Model
      - Jan Zill, University of Queensland
    - Observation of a Large Optical Phase Shift from a Single Atom
      - Benjamin Norton, Griffith University
    - Gauge Invariant Quilts in a Curved Space-time
      - Tommaso Demarie, Macquarie University
    - Coupling Metal Hydrides with Concentrated Solar Thermal Applications for Electricity Generation in Remote Areas
      - Craig Buckley, Curtin University
    - Hybrid As$_2$S$_3$ on Er Doped 160/0, Waveguide for Lossless Nonlinear Optics
      - Khu Vu, Australian National University
    - Three-photon Absorption in Quantum Dots Using Ultrastable Fibre Lasers
      - Matthew Petrasich, Griffith University

- **12D**
  - **Quantum Information, Concepts and Coherence 12:**
    - Coulombic Charge Ice
      - Aroon O'Brien, University of Sydney
    - Toxicological Optical Trap Potentials with a "Rb BEC
      - Mark Baker, University of Queensland
    - The Shadow of a Single Atom
      - Erik Streed, Griffith University
    - Australia and the Advanced LIGO Gravitational Wave Detector
      - Bram Slagmolen, Australian National University
    - Bathochromatic Shift in Photoabsorption Spectra of Organic Dye Sensitisers Through Structural Modifications for Better Solar Cells
      - Narges Mohammad, Swinburne University
    - Impact of Raman Noise and Dispersion on Photon-pair Generation in Chalcogenide (As$_2$S$_3$) Fibres
      - Martina Collins, University of Sydney
Monday 10 December 2012

0900 – 0945

**Plenary 1**

Room: Clancy Auditorium

Chair: Adi Paterson, Australian Nuclear Science and Technology Organisation NSW AUSTRALIA

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<th>Speaker</th>
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<th>Location</th>
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<tr>
<td>0900</td>
<td>Thomas Mason</td>
<td>Oak Ridge National Laboratory, TN UNITED STATES OF AMERICA</td>
<td>Clancy Auditorium</td>
<td>Science for the Energy Challenge</td>
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<td>Overcoming the energy challenge demands advances in technology. Close coupling of basic and applied research and development, with a sustained focus on translating discovery and innovation to practice, can accelerate the delivery of these advances.</td>
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0945 – 1030

**Plenary 2**

Room: Clancy Auditorium

Chair: Hans Bachor, Australian National University ACT AUSTRALIA

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<th>Speaker</th>
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<tr>
<td>0945</td>
<td>Svein Sjøberg</td>
<td>University of Oslo, NORWAY</td>
<td>Clancy Auditorium</td>
<td>What Can We Learn – and Not Learn – From Comparative Studies of Educational Achievement in Science?</td>
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<td>Studies like OECDs PISA (Program for International Student Achievement) has an increasing influence on educational policies in participating countries. The presentation will argue that these studies have fundamental problems and flaws as well as unwarranted influence.</td>
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1100 – 1230

**Concurrent Session 1A – Optics, Photonics and Lasers 1: Nanofabrication**

Room: CLB7

Chair: Heike Ebendorff-Heidepriem, University of Adelaide, SA AUSTRALIA

<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker</th>
<th>Institution</th>
<th>Location</th>
<th>Title</th>
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<tbody>
<tr>
<td>1100</td>
<td>William Arnold</td>
<td>ASML Holding Inc., UNITED STATES OF AMERICA</td>
<td>CLB7</td>
<td>Progress in Extreme Ultraviolet Lithography for IC Manufacturing</td>
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<td>Extreme ultraviolet lithography is developed to enable 1Xnm IC manufacturing. High numerical aperture step and scan systems have been constructed and deployed. Recent results and progress towards high volume manufacturing are reviewed.</td>
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<tr>
<td>1130</td>
<td>Benjamin Cumming</td>
<td>Swinburne University of Technology VIC AUSTRALIA</td>
<td></td>
<td>Adaptive Aberration Compensation for the Fabrication of Chalcogenide Gyroids</td>
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<td>Gyroid network structures are fabricated in the chalcogenide glass As2S3 by means of direct laser writing. An adaptive aberration compensation scheme is employed to reduce the total aberration magnitude by over an order of magnitude.</td>
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</table>
1145 – 1200  
Isabelle Staude  
Nonlinear Physics Centre, Australian National University ACT AUSTRALIA  
A Novel Hybrid Fabrication Approach for Three-dimensional Photonic Nanostructures  
We suggest a novel approach for fabricating three-dimensional (3D) metal nanostructures, which combines direct laser writing with electron-beam lithography. Using this approach we experimentally realize two key 3D structures of plasmonic metamaterials and nanoantennas.

1200 – 1215  
Adam Taylor  
Swinburne University of Technology VIC AUSTRALIA  
Alignment of Gold Nanorods by Photothermal Depletion, with Associated Single Particle Melting Studies  
Photothermal reshaping by a polarized laser is shown to impose alignment on as-made randomly aligned nanorod films, with aspect ratio dependent rod melting temperatures for these rods being also studied on a single particle basis.

1215 – 1230  
Xiangping Li  
Swinburne University of Technology VIC AUSTRALIA  
Updatable Digital Holographic Display in Nanoparticle-enabled Photorefractive Polymers  
This paper reports on the updatable digital holographic three-dimensional display in nanoparticle-sensitized photorefractive polymers. Applying the localised refractive-index modulation induced by the exciton-plasmon coupling mediated photorefractivity using a femtosecond pulsed laser beam in digital holographic display is demonstrated.

1100 – 1230  
Concurrent Session 1B – Condensed-Matter, Materials and Surface Physics 1: Graphene and Diamond  
Room: CLB 8  
Chair: Alex Hamilton, University of New South Wales, NSW AUSTRALIA

1100 – 1130  
Barbaros Özyilmaz  
National University of Singapore, SINGAPORE  
Graphene  
Here we show quasi-periodic nanoripple arrays introduce anisotropic charge transport and sets limits. I will also show our recent efforts in using a ferroelectric polymer coating to reduce the sheet resistance below values of ITO.

1130 – 1145  
Robert Elliman  
Australian National University ACT AUSTRALIA  
Optical Imaging of Graphene Using Phase Shift Interferometry  
Phase-shifting interferometric imaging is shown to be a powerful analytical tool for studying graphene films, providing quantitative analysis of large area samples with a thickness resolution of 0.05 nm.

1145 – 1200  
David Hoxley  
La Trobe University VIC AUSTRALIA  
Kelvin Probe Force Microscopy of the Diamond Surface Under Decane  
Scanning Kelvin Probe Force Microscopy is used to map the work function of hydrogen-terminated diamond surfaces on the sub-micron scale under an oil (decane). The values obtained are consistent with those obtained in air.

1200 – 1215  
Ewa Rej  
University of Sydney NSW AUSTRALIA  
Towards Hyperpolarised Nanodiamonds for Magnetic Resonance Imaging  
We report magnetic resonance experiments on diamond nanoparticles towards the development of MRI contrast agents based on 13C. Our purpose-built spectrometer allows for spin dynamics to be examined at ambient and milliKelvin temperatures.

1215 – 1230  
Morteza Aramesh  
University of Melbourne VIC AUSTRALIA  
Surface Modification of Porous Alumina Membranes with Nanodiamonds  
We will present our recent results of surface modification of porous alumina membranes with nano-diamond that dramatically improves their chemical stability and bio-compatibility.
**Concurrent Session 1C – Quantum Information, Concepts and Coherence 1: Optical Quantum Information**

**Room:** CLB 6  
Chair: Andrew White, University of Queensland QLD AUSTRALIA

**Time**  
1100 – 1130  
**Geoff Pryde**  
Griffith University, QLD AUSTRALIA  
**Overcoming Loss in Remote Entanglement Sharing**  
We demonstrate EPR-steering, by which Bob can verify shared entanglement with Alice, over a high-loss channel with the detection loophole closed. We also demonstrate heralded loss reduction of a qubit channel using a noiseless amplifier.

1130 – 1145  
**Sacha Kocsis**  
Griffith University QLD AUSTRALIA  
**Heralded Noiseless Amplification of a Photon Polarization Qubit**  
We demonstrate heralded loss reduction of a qubit channel, using a two-mode coherent noiseless amplifier operating on the polarization of a single photon. We increase transmission fidelity by up to a factor of five.

1145 – 1200  
**Bixuan Fan**  
University of Queensland QLD AUSTRALIA  
**The Breakdown of the Single-shot Microwave Photon Detection via Kerr-type Nonlinearity Induced by a Three-level System**  
We analyze Cross-Kerr phase shifts for photon counting and other quantum technologies. Using a generic atomic model we calculate the signal-to-noise (SNR) ratio for photon counting, and find atomic saturation effects require SNR<1.

1200 – 1215  
**Till Weinhold**  
University of Queensland QLD AUSTRALIA  
**Conclusive Quantum Steering with Superconducting Transition-edge Sensors**  
We demonstrate quantum steering between two parties by at least 48 standard deviations, closing the ‘detection loophole’ with an unprecedented 62% conditional detection efficiency by combining an optimised entangled photon-pair source with superconducting transition-edge sensors.

1215 – 1230  
**Andrew Wade**  
Australian National University ACT AUSTRALIA  
**Opto-Mechanical Upshifting of Scattered Light for Squeezed Light Measurement**  
Spurious scattered light reflections couple low frequency environmental noise into the homodyne measurement of squeezed light states. We present a method of path length dithering to frequency up-shift these parasitic interferences.

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**Concurrent Session 1D – Atomic and Molecular Physics 1: Anti-hydrogen / Positrons**

**Room:** CLB 5  
Chair: Michael Brunger, ARC Center for Antimatter-Matter Studies, Flinders University, SA AUSTRALIA

**Time**  
1100 – 1130  
**Mike Charlton**  
Swansea University, UNITED KINGDOM  
**Progress in Antihydrogen Physics and First Observations of Resonant Quantum Transitions**  
We describe how antihydrogen atoms have been stored for long periods in a neutral atom trap and subjected to microwave radiation to induce transitions between hyperfine levels of the ground state of the anti-atom.

1130 – 1145  
**Simon Armitage**  
University of North Texas, THE UNITED STATES OF AMERICA  
**Development of a Positron Reaction Microscope**  
Progress will be presented on the development of a positron reaction microscope for kinematically complete measurements of ionization of atomic and simple molecules at the Centre for Antimatter/Matter Studies (CAMS), Australian National University.
**Search for Positron Scattering Resonances in the Doubly Excited Region of the Helium Atom**

An experimental search for positron resonances in the doubly excited region of the helium atom has been conducted. Total scattering and positronium formation cross sections are presented and compared with recent theory.

**Kinetic Theory Model of Positron Transport in Gases and Liquids**

A kinetic theory model of positron transport in dilute gaseous and soft-condensed matter has been developed. Results are compared with existing dilute gas-phase benchmarks, and preliminary soft-condensed results are reported.

**Positron Binding to Excited States of Helium**

The existence of broad resonances in the positron excitation spectrum of helium was demonstrated by explicit calculations using two different theoretical approaches. Positrons were found to attach to three doubly excited states of neutral helium.

**Higgs Discovery: Opening a New Era of Particle Physics**

A new bosonic state was recently discovered at the Large Hadron Collider. Speculating that it is a Higgs boson, we review its impact on supersymmetry, the unification of all fundamental forces, dark matter and beyond.

**Standard Model Measurements at the Large Hadron Collider**

The LHC provides an excellent environment for testing the Standard Model of Particle Physics (SM) in a previously inaccessible energy regime. We present the status of SM measurements based on LHC running to date.

**K-Isomers in Neutron-Rich Tungsten Nuclei**

Isomeric states have been investigated in tungsten nuclei from A=182 to A=190, well beyond the heaviest stable isotope, 186W. Changes in deformation, in particular the triaxial deformation, result in a complex picture of changing configurations and transition strengths.

**Molecular Level Assessments of Ion Induced Biodamage: Multiscale Approach**

Multiscale approach to the physics of radiation damage considers a number of physical effects that happen on different scales in order to understand biological action on tissue irradiated with ions on the quantitative level.
1130 – 1145  **Hilary Byrne**  
*University of Sydney NSW AUSTRALIA*

**Radiation-Induced Biological Damage on Subcellular Scales: Beyond DNA**

A virtual cell model is developed to investigate the effects of biological damage caused by low-energy electromagnetic interactions that occur outside the cell nucleus. Implications for healthy tissue exposed during cancer radiotherapy treatment are discussed.

1145 – 1200  **Adam Briggs**  
*University of Wollongong NSW AUSTRALIA*

**Cerium Oxide Nanoparticles Exhibit an Energy-dependent Protection to 9L Cells Under Exposure to X-ray Radiation Fields**

Cerium oxide (CeO2) nanoparticles scavenge reactive oxygen species to confer radiation protection. We uncover energy-dependent radioprotection using CeO2 nanoparticles. We observe protection at megavolt energies and no protection when using kilovolt X-rays.

1200 – 1215  **Aimee McNamara**  
*University of Sydney NSW AUSTRALIA*

**Microdosimetric Comparison between Proton and X-ray Computed Tomography Scans**

A comparison of the dose distribution of proton and x-ray beams, applicable to computed tomography (CT) beam energies, on the micron or cellular scale using Monte Carlo simulations with a detailed pediatric head model.

1215 – 1230  **Dale Prokopovich**  
*Australian Nuclear Science and Technology Organisation, NSW AUSTRALIA*

**SOI Microdosimetry of Hadron Therapy Fields**

SOI microdosimetry of hadron therapy treatment beams both the HIMAC in Chiba Japan and HIT in Heidelberg Germany have been performed. In and out of field measurements of the treatment fields will be presented.

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**Concurrent Session 1G – ACOFT 1 Nonlinear Photonics**

**Room: CLB 2**

**Chair: Martijn de Sterke, University of Sydney NSW AUSTRALIA**

1100 – 1130  **Ben Eggleton**  
*University of Sydney NSW AUSTRALIA*

**Nonlinear Optical Phononics: Harnessing Sound and Light in Nonlinear Nanoscale Circuit**

The convergence of optics and phononics, enabled by new nonlinear materials in which acoustic phenomena can be excited on small scales and nanoscale structures that enhance the interaction between sound and light, is unlocking innovations for chip-based information processing. This paper will review our recent breakthroughs that harness this optical-phononic interaction for a new paradigm in information processing, including tunable slow light, frequency comb sources and microwave photonic signal processing.

1130 – 1145  **Mark Pelusi**  
*University of Sydney NSW AUSTRALIA*

**All-optical Pre-compensation of Fiber Nonlinearity for WDM RZ-DPSK 40 Gb/s Signals by Transmitter-based Phase Conjugation**

Compensation of optical fiber nonlinearity in dispersion managed links is demonstrated for 100 GHz-spaced WDM 40 Gb/s RZ-DPSK signals by applying nonlinear pre-distortion and phase-conjugation at the transmitter. The Q-factor is improved by 1.3-2.4 dB for four channels.

1145 – 1200  **Xin Gai**  
*CUDOS (LPC) The Australian National University ACT AUSTRALIA*

**Dispersion Engineered Ge_{1.5}As_{24}Se_{64.5} Chalcogenide Nanowires for Polarisation Independent Processing**

We demonstrate the design and fabrication of square Ge_{1.5}As_{24}Se_{64.5} (Ge11) nonlinear nanowires fully embedded in a silica cladding for polarization independent (P-I) nonlinear processing. A near P-I operation was obtained for FWM and supercontinuum generation.
1200 – 1215  **Yvan Paquot**  
*University of Sydney NSW AUSTRALIA*  
**Automatic DGD and GVD Compensator for a 640 Gb/s Single Channel Signal**  
We report the first demonstration of a real time all-optical compensator based on an integrated signal monitor for group velocity dispersion and differential group delay for ultra high symbol rate (640 Gb/s) signals.

1215 – 1230  **Ben Eggleton**  
*University of Sydney NSW AUSTRALIA*  
**Photonic Chip Based Narrowband Tunable and Reconfigurable Microwave Photonic Filter Using Stimulated Brillouin Scattering**  
We demonstrate a photonic-chip based narrowband, tunable microwave photonic filter with shape and bandwidth reconfiguration. The filter has a stable amplitude (20 2dB) and bandwidth (23 2 MHz) over 2-12 GHz resulting in high Q ~520.

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**Concurrent Session 1H – Plasma Physics**  
Room: CLB 1  
Chair: Brian James, University of Sydney NSW AUSTRALIA

**Time**

1100 – 1130  **Matthew Hole**  
*Australian National University ACT AUSTRALIA*  
**The Potential for Australian Participation in ITER**  
ITER is the next step fusion experiment, designed to explore the physics of burning plasmas and demonstrate the technical feasibility of fusion power. I will outline our capacity to participate in the world’s largest experiment.

1130 – 1145  **Amanda Rider**  
*CSIRO NSW AUSTRALIA*  
**Plasmas Meet Plasmonics: Fundamental Physical Links and How to Make the Best of Them**  
Physical links between classical plasma physics and plasmonics will be discussed, with analogies drawn between macro- (and micro-) scale gaseous plasmas and plasmons (essentially nanoscale metal plasmas). These fundamental similarities can be exploited in nanotechnological devices.

1145 – 1200  **Anthony Murphy**  
*CSIRO Materials Science And Engineering NSW AUSTRALIA*  
**Metal Vapour in Arc Welding: Its Influence on the Arc and Weld, and the Formation of Fume Particles**  
We examine the physics underlying the formation of metal vapour in arc welding, its (very significant) effects on the arc and weld, and the formation of fume particles from the vapour.

1200 – 1215  **Eugene Tam**  
*CSIRO NSW AUSTRALIA*  
**Three-Dimensional Modelling of a Carbon Arc Discharge for Nanostructure Production**  
We present details of three-dimensional simulations of dc arcs between carbon electrodes. The model is applied to investigate how various parameters can affect nanostructure production.

1215 – 1230  **Dominic Poznic**  
*University of Sydney NSW AUSTRALIA*  
**Determination of the Electron Energy Distribution Function Using Integrated Data Analysis**  
A analysis framework is presented that determines the electron energy distribution function of an argon discharge plasma through the integrated data analysis of optical emission spectroscopy and Langmuir probe diagnostics.
1330 – 1500

Concurrent Session 2A – Optics, Photonics and Lasers 2: Classical Optics: From Fundamentals to Fabrication

Room: CLB 7
Chair: Christopher Poulton, University of Technology NSW AUSTRALIA

Time
1330 – 1400  Pieter Dumon
Imec BELGIUM
Silicon Photonics for Interconnects and Biotechnology
We developed an integration platform for photonic integrated circuits in 200mm and 300mm wafer CMOS facilities. Sporting waveguide devices, modulators, and photodetectors, we demonstrate applications such as short-range optical interconnects as well as biosensors.

1400 – 1415  Vincent Loke
University of Queensland QLD AUSTRALIA
Designing Optically-Driven Microrotors for Maximum Torque Efficiency
We discuss how computational modelling is used as an aid in designing an optically-driven microrotor for optimal torque. The discrete dipole approximation method with symmetry optimization is use to formulate the T-matrix of the microrotor.

1415 – 1430  Andrey Sukhorukov
Australian National University ACT AUSTRALIA
In-band Localised Fano Surface States in Periodic Waveguiding Lattices
We predict theoretically and demonstrate experimentally a novel surface state based on a Fano resonance which facilitates complete electromagnetic field localization although the mode frequency is embedded in a transmission band of a semi-infinite waveguide lattice.

1430 – 1445  Ivan Fernandez-Corbaton
Macquarie University NSW AUSTRALIA
Helicity and Angular Momentum – Symmetry-based Study of Light-Matter Interactions
We propose a new theoretical and practical framework for the study of light-matter interactions and the angular momentum of light. Our proposal is based on helicity, total angular momentum, and the use of fundamental symmetries.

1445 – 1500  Xavier Vidal
Macquarie University NSW AUSTRALIA
Helicity Conservation Rules for Designing Optimal Chiral Structures
We show the fundamental relation between optical activity and helicity conservation in chiral particles. Such relation imposes certain symmetry restrictions on the particle, which we study here.

1330 – 1500

Concurrent Session 2B – Condensed-Matter, Materials and Surface Physics 2: Bulk Magnetism

Room: CLB 8
Chair: Glen Stewart, University of New South Wales ACT AUSTRALIA

Time
1330 – 1400  Maxim Avdeev
Australian Nuclear Science and Technology Organisation NSW AUSTRALIA
High Temperature Structural and Magnetic Transitions in Perovskite-type Technates ATcO₃ (A=Ca, Sr)
Perovskite-type oxides ATcO₃ (A=Ca, Sr) were studied by in situ X ray and neutron powder diffraction in a wide temperature range. On heating crystal structure evolves from orthorhombic toward cubic while magnetic ordering persists up to extraordinarily high temperature (TN ~ 800 K, 1000 K).

1400 – 1415  Sebastian Sambale
MacDiarmid Institute NEW ZEALAND
Magnetic and Electronic Properties of FeSr₂₋ₓCeₓCo₂₋ₓO₇⁺ₓ (Fe1222)
We have successfully synthesized FeSr₂₋ₓCeₓCo₂₋ₓO₇⁺ₓ (Fe1222) with a wide Ce concentration range. We observed a spin-glass transition from the FeOx layer at ~26 K and variable range hopping. A large magnetoresistance is observed below the spin-glass temperature.
Richard Mole
Australian Nuclear Science and Technology Organisation NSW AUSTRALIA
Neutron Scattering Studies of YbMn2Si2
The results of our neutron scattering investigation of the rare earth intermetallic YbMn2Si2 are presented. Inelastic scattering is used to elucidate the nature of the interaction between the transition metal and rare earth sublattices.

Annemieke Mulders
University of New South Wales ACT AUSTRALIA
Neutron and Synchrotron Studies of Iron Based Multiferroic Materials
Magnetoelectric interactions in advanced multiferroic materials, where ferroelectricity and magnetism coexist and interact, are of much current interest. The magnetic moments and electric dipoles are investigated on a fundamental level using neutron and resonant x-ray diffraction techniques.

1330 – 1500
Concurrent Session 2C – Quantum Information, Concepts and Coherence 2: Optical Quantum Computing
Room: CLB 6
Chair: Geoff Pryde, Griffith University QLD AUSTRALIA

1330 – 1345
Franck Ferreyrol
Griffith University QLD AUSTRALIA
Implementation of a Quantum Fredkin Gate Using an Entanglement Resource
We experimentally realise an optical quantum Fredkin gate. We use an entanglement resource and an expanded Hilbert space technique for adding control to an arbitrary quantum operation, leading to a quite simple experimental setup.

1345 – 1400
Robin Stevenson
Australian National University ACT AUSTRALIA
Rephased Amplified Spontaneous Emission as a Single Photon Source
In this presentation I show how Rephased Amplified Spontaneous Emission can be configured as a high efficiency single photon source.

1400 – 1415
Zhizhong Yan
University of Waterloo CANADA
Novel Bias Mode to Enhance Detection Efficiency and Signal to Noise Ratio For Superconducting Nanowire Single Photon Detector
When an RF bias current is applied in presence of dc bias to a Superconducting Nanowire Single Photon Detector, the measurement results demonstrate over 100 times enhancement of Device Quantum Efficiency (DQE) and Signal to Noise Ratio (SNR).

1415 – 1430
Keyu Xia
Macquarie University NSW AUSTRALIA
Deterministic Generation of a Photon Fock State on Demand from a Solid-State System
Using an optical toroidal cavity coupled to a Nitrogen-vacancy center in a nanodiamond, we present a method to deterministically and on-demand generate pure photon Fock states with high photon occupation in the visible light frequency.

1430 – 1445
Seiji Armstrong
University of Tokyo / Australian National University ACT AUSTRALIA
Shortening of Measurement-Based Quantum Computation Algorithm Using Temporal-Made Continuous-Variable Cluster States
We show how to shorten certain algorithms for measurement-based quantum computations using temporal-mode continuous-variable cluster states. Our method makes use of the fact that there are multiple modes per logical node in such states.

1445 – 1500
Austin Lund
University of Queensland QLD AUSTRALIA
Non-Symplectic Gaussian Operations Generated by Non-deterministic Noiseless Linear Amplification
Non-deterministic noiseless linear amplification generates a Gaussian non-symplectic transformation of the mean vector and covariance matrix. This non-symplectic map helps in the understanding of non-deterministic amplification and also uncovers a variety of surprising new phenomena.
1330 – 1500

Concurrent Session 2D – Atomic and Molecular Physics 2: Chemical Physics
Room: CLB 5
Chair: Jason Gascooke, Flinders University SA AUSTRALIA

Time
1330 – 1400   
Warren Lawrance  
*Flinders University SA AUSTRALIA*

The Dissociation Dynamics of NO-based Van Der Waals Complexes Probed By Imaging Techniques
The dissociation dynamics of van der Waals complexes of NO have been studied by a combination of velocity map imaging and two dimensional laser induced fluorescence, providing binding energies and correlated product distributions.

1400 – 1415   
Michael Pullen  
*Swinburne University of Technology VIC AUSTRALIA*

Quasi-phase Matched High Harmonic Generation Using a Dual Gas, Multi Jet Array
We present an improved method of quasi-phase matched high harmonic generation using a dual gas, multi jet array. Individual control of the gas jet pressures allows more degrees of freedom over other schemes.

1415 – 1430   
Mitsu Kono  
*Australian National University ACT AUSTRALIA*

Hyperfine Structure and Isotope Shifts in Sub-doppler Two-photon-excitation Rydberg Spectra of Xenon
Diverse angular-momentum-dependent isotope energy shifts and hyperfine structure are measured for 33 high-energy Rydberg levels of atomic xenon by sub-Doppler two-photon excitation spectroscopy, using narrowband pulsed coherent UV light at 205-213 nm.

1430 – 1445   
Russell McLean  
*Swinburne University of Technology VIC AUSTRALIA*

Spectral Properties of Far-infrared and Blue Light Generated in Rb Vapour
The properties of blue light resulting from wave mixing of resonant low-power laser radiation in Rb vapour have been used for evaluating spatial and temporal coherence of the 5.2 μm radiation generated as a result of population inversion.

1445 – 1500   
Stephen Gibson  
*Australian National University ACT AUSTRALIA*

Velocity-map Imaging of Photoelectrons
Velocity-map imaging is now capable of providing relative electron kinetic energy resolutions of <0.4%, giving detailed spectra that reveal new information on the structure of the anion and neutral, and the dynamics of the photodetachment process.

1330 – 1500

Concurrent Session 2E – Nuclear and Particle Physics 2
Room: CLB 4
Chair: Andrew Stuchbery, Australian National University ACT AUSTRALIA

Time
1330 – 1400   
David Hinde  
*Australian National University ACT AUSTRALIA*

Zeptosecond Dynamics of Superheavy Element Formation
The formation of new superheavy elements by fusion of two heavy nuclei is severely inhibited by quasi-fission, in which the system breaks apart early. New measurements reveal reaction time-scales and the important variables controlling quasi-fission.

1400 – 1415   
Guilherme Nunes Hanninger  
*University of Melbourne VIC AUSTRALIA*

MSSM Higgs Boson Searches with Tau Leptons in the Final State at ATLAS
Searches for Minimal Supersymmetric Standard Model (MSSM) Higgs bosons decaying to τ leptons performed with the ATLAS detector at the LHC are presented.
**Bomb Plutonium at the Source: a Time Sequence from an Enewetak Coral**

Plutonium isotopes have been measured in a coral from Enewetak atoll that was growing throughout the period 1952-1958 of extensive nuclear testing at the atoll. Signatures of individual tests are clearly observed.

**Fission Time Scale in 203At**

Measurement and consistent analysis of pre-scission neutron, proton, alpha particle and gamma ray and evaporation residue cross-sections for 28Si+175Lu->203At system at 159MeV to probe the fission time scale are presented.

**Structural Properties of Southern Ocean Pteropods**

This study aims to determine the impact of ocean acidification on Southern Ocean pteropods via a detailed understanding of the structural and mechanical properties of their shells.

**Structural Changes in Elastin Hydrogel During Cyclic Tensile Deformation and Drying by Synchrotron SAXS**

Time resolved synchrotron small angle x-ray (SAXS) measurements are made on a cyclically stretched free standing film of elastin. The originally isotropic scattering pattern becomes anisotropic when stretched. Other structural changes become apparent as the film dries.

**Tumour Tracking in Cancer Radiotherapy: from Mathematical Formalism to Clinical Implementation**

Medical linear accelerators are used to treat prostate cancer. Prostate tumour position determination is critical during treatment. A novel method has been clinically tested, utilizing 2-dimensional to 3-dimensional reconstruction, allowing real-time measurements with sub-millimeter accuracy.
**Concurrent Session 2G – ACOFT 2 Photonic Crystal Fibres**

Room: CLB 2  
Chair: Michael Digonnet, Stanford University UNITED STATES OF AMERICA

**Time**  
1330 – 1400  
**Nicolas Joly**  
Max-Planck Institute for the Science of Light GERMANY  
Nonlinear Optics in Gas-filled Hollow-core Kagomé Photonic Crystal Fiber  
Pressure-control of dispersion in noble-gas-filled hollow-core kagome fibre allows compression of ultrashort μJ pulses to few-cycle durations. Recent results include efficient tunable dispersive waves in the deep UV and a plasma-related soliton self-frequency blue shift.

1400 – 1415  
**Alex Clark**  
University of Sydney NSW AUSTRALIA  
Photon-Pair Generation in Ultra-Compact Photonic Crystal Devices  
We report our progress in ultra-compact photonic crystal platform for photon-pair generation through spontaneous four-wave mixing. We generate correlated pairs with a coincidence-to-accidental ratio as high as 130 and compare silicon and GaInP device performance.

1415 – 1430  
**Samuel Legge**  
University of Newcastle NSW AUSTRALIA  
Spatio-spectral Identification of Solitons Occupying Higher Order Electromagnetic Modes in Photonic Crystal Fibre  
Solitons occupying higher order electromagnetic modes in photonic crystal fibre have been generated. The unique spatial and spectral measurement of a supercontinuum output field details characteristic signature wavelengths and mode structure not previously observed.

1430 – 1445  
**Alvaro Casas Bedoya**  
University of Sydney NSW AUSTRALIA  
Slow Light Dispersion Engineering of Photonic Crystal Waveguides Using a Selective Microfluidics Infiltration  
We demonstrate experimentally dispersion engineering in slow light photonic crystals waveguides using a selective liquid infiltration technique. The photonic crystal waveguide exhibits group velocity of ~c/80 that depends on the liquid physical properties.

1445 – 1500  
**Barry Luther-Davies**  
Australian National University ACT AUSTRALIA  
Supercontinuum Generation in the Mid-infrared from Dispersion-engineered As2S3 Glass Waveguides  
We report the generation of a mid-IR supercontinuum created by passing 7-8ps pulse duration pulses at ≈3260nm through a dispersion-engineered As2S3 waveguide

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**Concurrent Session 2H – Acoustic, Music and Ultrasonics and History of Physics**

Room: CLB 1  
Chair: Richard Newbury, University of New South Wales NSW AUSTRALIA

**Time**  
1330 – 1345  
**Joe Wolfe**  
University of New South Wales NSW AUSTRALIA  
How the Human Voice is Not Suited for Singing and What This Implies About Music  
Musics requiring independent control of pitch and loudness are somewhat difficult for the voice, whose pitch and loudness are strongly correlated. From that perspective, this paper discusses advantages and possible origins of fixed pitch singing.

1345 – 1400  
**Daniel Creedon**  
University of Western Australia WA AUSTRALIA  
Extremely High Q-factor Mechanical Modes in Quartz Bulk Acoustic Wave Resonators at Millikelvin Temperature  
Quartz BAW resonators demonstrate mechanical quality factors of several billion when cooled below 20 millikelvin. The Q-factor near the quantum ground state can be four orders of magnitude better than previously attained, with applications to quantum information and control.
An Investigation into the Effect of the Electric Guitar Body on the Harmonic Content of its Output

The electric guitar produces sound by directly converting the string vibrations to an electrical signal. In this paper we investigate luthiers’ claims that the solid body of the guitar affects the quality of its sound.

The Heterodyne Description of Matter Waves

The self-field model, de Broglie’s double solution and Schrodinger’s smeared particle, give a background for derivation of waves with properties identical to de Broglie’s matter waves. The origin, nature and implications of such waves are then discussed.

The History of Radiation Pressure and the Unity of Physics Exposed through the Inertia of Energy

Radiation pressure has a long history, from Kepler to modern applications such as optical tweezers. The underlying principle – the inertia of energy – shows essential links between classical mechanics, thermodynamics, and relativity.

Strong Chiral Optical Response from Planar Plasmonic Metamaterials

The chiral optical response refers to an ability to distinguish between states of circular polarization. We show using theory and experiment how a strong chiral response is obtained using arrays of subwavelength-scale plasmonic structures.

Excitation of Single Multipolar Resonances

A new method to excite single multipolar resonances and control the scattered field from spheres is shown. Our method uses the spatial properties of light and is valid for the non-paraxial regime.

Coupling Stabilisation of Microresonators

We present a laser homodyne technique to actively stabilize the critical coupling of a microresonator by controlling the evanescent coupling gap to a tapered optical fibre with an inferred stability of better than 1 pm/√Hz.

Wideband Optical Activity in Coupled Chiral Meta Atoms

We stack alternate layers of a meta-atom and its complementary structure, coupling magnetic and electric dipole responses. This results in broadband polarization rotation, with corresponding low ellipticity.

Biosensing with Microresonators using the Backscattered Light

We show that biosensing with microresonators using the backscattered light allows shot noise limited particle detection that is insensitivity to laser phase noise and therefore broadly applicable.
1645 - 1700

**Sergey Kruk**  
*Australian National University ACT AUSTRALIA*

**Multilayer Fishnet Metal-Dielectric Structures as Magnetic Hyperbolic Metamaterials**

We study anisotropic optical properties of multilayer fishnet metamaterials and reveal that they exhibit hyperbolic dispersion. This unique magnetic form of hyperbolic media is promising for the control of enhanced spontaneous emission.

### 1530 – 1700

**Concurrent Session 3B – Condensed-Matter, Materials and Surface Physics 3: Spintronics and Magnetic Films**

*Room: CLB 8*  
*Chair: Jim Williams, University of Western Australia WA AUSTRALIA*

#### 1530 – 1600

**David Cortie**  
*Australian Nuclear Science and Technology Organisation*

**The Magnetic Velcro Effect: Improved Model of Ferromagnet/Antiferromagnet Interfaces**

Polarised neutron reflectometry was used to determine the magnetic depth profile of a Ni80Fe20/Fe2O3 thin film. A three-dimensional Monte Carlo simulation was developed to implement a realistic Hamiltonian, and account for the microstructure, to model the exchange-bias behavior.

#### 1600 – 1615

**Oleg Sushkov**  
*University of New South Wales NSW AUSTRALIA*

**Does the Side Jump Effect Exist?**

It is widely accepted that the side jump effect is a major mechanism for spintronics. We demonstrate that this accepted view is wrong. The effect is so small that practically it is irrelevant.

#### 1615 – 1630

**Joel Bertinshaw**  
*University of New South Wales / Australian Nuclear Science and Technology Organisation, NSW AUSTRALIA*

**Polarised Neutron and X-ray Resonant Magnetic Reflectivity Studies of Multiferroic Thin Fil**

Bismuth Ferrite (BiFeO3) is a multiferroic compound with potential use in functional thin film heterostructures, like tunnel junctions. Using neutron and resonant X-ray reflectometry, we have studied La0.67Sr0.33MnO3/BiFeO3 bilayers, focusing on intriguing interfacial physics.

#### 1630 – 1645

**Sergey Samarin**  
*University of Western Australia WA AUSTRALIA*

**Probing Surface Magnetism by Spin-polarized Single- and Two-electron Spectroscopy**

Analysis of the spin-dependent interaction of low-energy electrons with ferromagnetic surfaces and thin filmprovides information on their spin-dependent electronic structure.

#### 1645 – 1700

**Frank Klose**  
*Australian Nuclear Science and Technology Organisation, NSW AUSTRALIA*

**Magnetic Nanostructures Investigated with Neutron Scattering Methods**

Magnetic thin film nanostructures are crucial to numerous applications in data storage and other electronic devices. This paper will present striking examples which illustrate the usefulness of neutron scattering in magnetic thin film research.

### 1530 – 1700

**Concurrent Session 3C – Quantum Information, Concepts and Coherence 3: Optical Quantum Memories**

*Room: CLB 6*  
*Chair: Andrew Truscott, Australian National University ACT AUSTRALIA*

#### 1530 – 1600

**Ping Koy Lam**  
*Australian National University ACT AUSTRALIA*

**Performing Quantum Operations within Memories**

We present a new method for performing quantum operations with a series of high efficiency quantum memories. Our memory scheme is based on a photon echo process that stores light via Fourier decomposition.
Gradient Echo Memory Using Cold Atoms

Currently there exists a demand for quantum memories. One promising candidate is the gradient echo memory scheme (GEM). We present the latest experimental results from our move from warm to cold atom to improve GEM.

Input Output Analysis of the Storage of Single Photons in Quantum Memories

We examine a quantum memory performed using the GEM protocol with single photon inputs using input output theory. Furthermore, we consider the conditional behavior of the memory when the output is monitored.

Theory of an Atomic Bragg Interferometer

We theoretically analyse recent experimental results of a precision atomic gravimeter based on Bragg diffraction with thermal atoms, and consider the potential for improvement by using a narrower momentum-width source such as BEC.

Ion-ion Interactions Between Qubits in EuCl3.6D2O

We present measurements of ion-ion interactions between prototype qubits in EuCl3.6D2O, and show that the interactions are not adequately described by an electric dipole-dipole model. We describe a method for enacting gates using these interactions.

Concurrent Session 3D – Atomic and Molecular Physics 3: Positron Scattering Theory

Benchmark Calculations of Electron and Positron Scattering on Atoms

There has been much progress in the field of electron- and positron-atom collisions during the last decade. The talk will give an overview of the recent advances and present a number of unique benchmark results.

Positrophilic Electrons in Positron-electron Annihilation Process of Molecules

The study, an ARC DP project, proposes that positrophilic molecular electrons of a target molecule, rather than all electrons in the molecule, dominate the annihilating process and the Doppler-shift of the gamma-ray spectra of molecules. Preliminary results are given.

Detecting Positron-Atom Bound States through Resonant Annihilation and Scattering

A method is proposed for detecting positron-atom bound states by observing enhanced positron annihilation due to electronic Feshbach resonances. Positron binding energies for a range of open-shell transition metal atoms have been calculated.

Convergent Close-Coupling method for positron scattering from noble gases

The convergent close-coupling method has been applied to positron scattering from noble gases. The scattering calculations have been performed in the single-center approximation with target wave functions calculated within a model of one-electron excitations from the outermost p6 shell.

Positron Scattering from the H^+_{2} and H_{2} Molecules Using the Convergent Close-Coupling Method

Positron scattering from diatomic molecules has been investigated using the single center convergent close-coupling method. A fixed nuclei formulation was used to obtain total cross sections, which are compared with available experimental and theoretical data.
1530 – 1700

**Concurrent Session 3E – Nuclear and Particle Physics 3**

*Room: CLB 4*

*Chair: Csaba Balazs, Monash University, VIC AUSTRALIA*

**Time**

1530 – 1600

*Martin Sevior*

_University of Melbourne VIC AUSTRALIA_

**The Belle II Experiment at the Super KEKB Accelerator**

The requirements for the next-generation B-factory at KEK in Japan, consisting of the SuperKEKB accelerator and Belle II detector are presented, along with the present status of the project.

1600 – 1615

*Boon Lee*

_Australian National University ACT AUSTRALIA_

**Auger Electron Emission in Nuclear Decay**

Auger electrons emitted in nuclear decay offer a unique tool to treat cancer cell at the scale of a DNA molecule. We present a new model to evaluate the energy spectrum of Auger electrons, and hence overcome the limitations of existing computations.

1615 – 1630

*Janina Grineviciute*

_Charles Darwin University NT AUSTRALIA_

**Relativistic R Matrix and Continuum Shell Model**

The R matrix formalism has been extended to the relativistic case so that the many-coupled channels problem may be solved for system which binary breakup channels satisfy a relative Dirac equation.

1630 – 1645

*Sophie Dawson*

_University of Melbourne VIC AUSTRALIA_

**Performance of the Upgraded Optical Fill Pattern Monitor at the Australian Synchrotron 3 GeV Electron Storage Ring**

The fill pattern monitor on the optical diagnostic beamline at the Australian Synchrotron 3 GeV electron storage ring was upgraded to improve performance. New electronics and optical fibre coupling to the photodiode has been added.

1645 – 1700

*Cameron Cuthbert*

_University of Sydney NSW AUSTRALIA_

**Search for Xb decays to the Upsilon(1S) pi+ pi- final state using the ATLAS detector**

We present a study of the Upsilon(1S)pi+pi-final state at the ATLAS experiment. This mode can be used to study conventional bottomonium mesons, and a hypothetical analogue (“Xb”) of the candidate exotic state X(3872).

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1530 – 1700

**Concurrent Session 3F – Biophysics 1**

*Room: CLB 3*

*Chair: Roger Fulton, University of Sydney NSW AUSTRALIA*

**Time**

1530 – 1600

*Steve Meikle*

_The University of Sydney NSW AUSTRALIA_

**Towards Simultaneous Brain PET Imaging and Behavioural Studies in Freely Moving Animals**

We are developing a PET imaging system for simultaneously measuring the brain function and behaviour of freely moving rats. This paper describes progress towards that goal and initial validation results from a pilot animal study.

1600 – 1615

*David Simpson*

_University of Melbourne VIC AUSTRALIA_

**In Vivo Imaging of Nanodiamonds in Drosophila Melanogaster**

We report in vivo imaging of nanodiamonds in the Drosophila melanogaster embryo. Fluorescence correlation spectroscopy and widefield imaging techniques are used to track and determine the motion of the nanodiamonds during the celluarisation stage of embryonic development.

1615 – 1630

*Dayong Jin*

_Macquarie University NSW AUSTRALIA_

**Time-domain Biophotonics: Powering Next-generation Molecular Diagnostics**

Engineering to tune the lanthanide bioprobes in both spectral and temporal domains, smart Biophotonics platform are devised to detect trace amounts of cells and molecular disease markers with high speed, super-resolution and low uncertainty.
<table>
<thead>
<tr>
<th>Time</th>
<th>Session Title</th>
<th>Speaker</th>
<th>Affiliation</th>
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<tbody>
<tr>
<td>1630 – 1645</td>
<td><strong>Shan Shan Kou</strong></td>
<td>University of Melbourne VIC AUSTRALIA</td>
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<tr>
<td></td>
<td><strong>Three-dimensional (3D) Optical Bioimaging with Quantitative Phase</strong></td>
<td></td>
<td>The morphological behavior of cells and organisms in their natural living state are of paramount importance for biomedical studies. Here we present several novel techniques that will underpin the final goal of “super-resolved” 3D microscopy.</td>
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<tr>
<td>1645 – 1700</td>
<td><strong>Asma Khalid</strong></td>
<td>School of Physics, University of Melbourne VIC AUSTRALIA</td>
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<tr>
<td></td>
<td><strong>Silken Nanodiamonds: New Compound for Bio-sensing Applications</strong></td>
<td></td>
<td>We demonstrate fluorescence, single photon emission and enhanced collection efficiency from nanodiamonds coated on the marked silicon substrate and embedded in silk. This combination has the potential to create a new compound for bio-sensing applications.</td>
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<tr>
<td>1530 – 1700</td>
<td><strong>Concurrent Session 3G – ACOFT 3 Photonic Devices 1</strong></td>
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<td></td>
<td><strong>Room: CLB 2</strong></td>
<td></td>
<td>Chair: Sergio Leon-Saval, University of Sydney NSW AUSTRALIA</td>
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<tr>
<td>1530 – 1600</td>
<td><strong>Tim Birks</strong></td>
<td>University of Bath, UNITED KINGDOM</td>
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<td></td>
<td><strong>Gratings in Multi-core Fibres / Photonic Lanterns</strong></td>
<td></td>
<td>By tapering a multicore optical fibre with Bragg gratings written into its 120 single-mode cores, a multimode “photonic lantern” spectral filter with applications in astronomy can be made.</td>
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<tr>
<td>1600 – 1615</td>
<td><strong>Christopher Betters</strong></td>
<td>University of Sydney NSW AUSTRALIA</td>
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<td></td>
<td><strong>Results of a Single-mode Multicore Fibre Bundle Fed Diffraction-Limited Spectrograph</strong></td>
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<td>Here we present a method for feeding a compact diffraction-limited spectrograph that exploits a single-mode fibre bundle/multicore fibre to simplify overall design and optimize use of detector real estate.</td>
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<td>1615 – 1630</td>
<td><strong>Kelvin Chung</strong></td>
<td>University of Melbourne VIC AUSTRALIA</td>
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<tr>
<td></td>
<td><strong>Broadband Optical Devices Using Adiabatic Passage</strong></td>
<td></td>
<td>We numerically demonstrate a three-rib waveguide structure for coherent tunneling adiabatic passage. We also present a five-rib structure that is a new class of octave spanning power divider.</td>
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<tr>
<td>1630 – 1645</td>
<td><strong>John Love</strong></td>
<td>Australian National University ACT AUSTRALIA</td>
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<td></td>
<td><strong>Y-Junction Based Splitters and Combiners for Few-Mode Optical Fibre Networks</strong></td>
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<td>It is shown how planar Y-junction based combiners and splitters can form the basis for the individual excitation and detection of the fundamental and low-order modes in a few-mode optical fibre network.</td>
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<tr>
<td>1645 – 1700</td>
<td><strong>Nigel Hoschke</strong></td>
<td>CSIRO NSW AUSTRALIA</td>
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<td></td>
<td><strong>Fibre Bragg Grating Networks for Robust Sensing Systems</strong></td>
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<td>The results of a feasibility study into a network of fibre Bragg grating sensors are presented. A networked optical sensing system is robust to fibre breakage through the ability to route light around damaged regions</td>
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<tr>
<td>1530 – 1700</td>
<td><strong>Concurrent Session 3H – Environmental Physics</strong></td>
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<td></td>
<td><strong>Room: CLB 1</strong></td>
<td></td>
<td>Chair: Dave Cohen, Australian Nuclear Science and Technology Organisation NSW AUSTRALIA</td>
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<tr>
<td>1530 – 1600</td>
<td><strong>Mario De Cesare</strong></td>
<td>Australian National University ACT AUSTRALIA</td>
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<td></td>
<td><strong>Monitoring of Plutonium and Uranium-236 in and around a Decommissioned Nuclear Power Plant in Italy</strong></td>
<td></td>
<td>In this work we present preliminary results on environmental and structural samples collected in and around a Nuclear Power Plant in Italy. The sample measurements were obtained with the CIRCE and ANU Asystems.</td>
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</tbody>
</table>
**Stephen Tims**  
Australian National University ACT AUSTRALIA  

**Measurements of Low-level Anthropogenic Actinides from Soils around Maralinga**  
Plutonium and uranium isotopes have been measured in soils collected from around the Maralinga nuclear weapons test site. A significant deviation from the accepted average global fallout $^{240}\text{Pu}/^{239}\text{Pu}$ ratio is observed.

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**Rajeev Lal**  
Australian National University ACT AUSTRALIA  

**Using Meteoric Be-10 to Estimate Soil Residence Times and Geologic Denudation Rates in Northern Territory, Australia**  
We use meteoric Be-10 measurements to estimate soil residence times and geological erosion rates in a monsoon climate, in northern Australia.

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**Peter Schouten**  
CSIRO, VIC AUSTRALIA  

**Estimation of Fugitive Emissions from Small-Scale Wastewater Treatment Facilities Using an Infrared Gas Analysis System**  
Methane and nitrous oxide emissions were measured at decentralised wastewater treatment plants across Melbourne using an infrared gas analyser. The results show that decentralised plants are high emitters of methane and nitrous oxide. As such, operators should consider refining their treatment regimes to reduce these emissions.

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**Andrew Charles**  
Bureau of Meteorology, VIC AUSTRALIA  

**Prediction of Tropical Cyclone Seasonal Risk with Dynamical Climate Models**  
The feasibility of using physically based general circulation models for seasonal forecasting of tropical cyclone risk in the South Pacific is assessed. Practical limitations on the predictability of seasonally averaged tropical cyclone activity are discussed.

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**Tuesday 11 December 2012**

**0900 – 0945**  
Plenary 3  
Room: CLB 7  
Chair: Ben Eggleton, University of Sydney NSW AUSTRALIA  

**Jelena Vuckovic**  
Stanford University CA USA  

**Quantum Dots in Optical Nanocavities: from Cavity QED to Device Applications**  
Quantum dots in optical nanocavities are interesting both as a test-bed for fundamental studies of light-matter interaction (a field known as cavity quantum electrodynamics - cavity QED), as well as an integrated platform for both quantum and classical information processing.

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**0945 – 1030**  
Plenary 4  
Room: CLB 7  
Chair: David Hinde, Australian National University ACT AUSTRALIA  

**Bradley Sherrill**  
Michigan State University USA  

**Search for the Origin and Stability of the Elements**  
Unanswered questions in nuclear science include how the elements were formed in nature and the limits of atomic nuclei both in atomic number and in neutron number. Answers require production and study of rare isotopes.
1100 – 1230

**Concurrent Session 4A – Optics, Photonics and Lasers 4: Lasers**

*Room: CLB 7*

Chair: David Spence, Macquarie University NSW AUSTRALIA

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<tr>
<td>1100 – 1130</td>
<td>Lap Van Dao</td>
<td>Swinburne University VIC AUSTRALIA</td>
<td>Phase-matched Generation of High Order Harmonics Radiation and Application</td>
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<td>1130 – 1145</td>
<td>Miftar Ganija</td>
<td>University of Adelaide SA AUSTRALIA</td>
<td>High Brightness High Power Yb:YAG End Pumped Cryogenic Zig Zag Slab Laser</td>
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<tr>
<td>1145 – 1200</td>
<td>Michael Lee</td>
<td>University of Sydney NSW AUSTRALIA</td>
<td>Frequency Locking of a 369nm Laser by Nonlinear Spectroscopy of Ytterbium Ions in a Discharge</td>
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<tr>
<td>1200 – 1215</td>
<td>Harrison Ball</td>
<td>University of Sydney NSW AUSTRALIA</td>
<td>A Novel High-power, Frequency-stabilised Solid-state 313 nm Laser System for 9Be⁺ ion Trapping</td>
</tr>
<tr>
<td>1215 – 1230</td>
<td>David Coutts</td>
<td>Macquarie University NSW AUSTRALIA</td>
<td>Generation of Spiral Beam with Multimode Optical Fibres</td>
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1100 – 1230

**Concurrent Session 4B – Condensed-Matter, Materials and Surface Physics 4: Material Physics**

*Room: CLB 8*

Chair: Anita Hill, CSIRO, VIC AUSTRALIA

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<tr>
<td>1100 – 1115</td>
<td>Erich Kisi</td>
<td>University of Newcastle NSW AUSTRALIA</td>
<td>Neutron Diffraction Studies of the Stress Distribution in Particulate Materials</td>
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<tr>
<td>1115 – 1130</td>
<td>Michael Cortie</td>
<td>University of Technology Sydney NSW AUSTRALIA</td>
<td>Molecular Dynamics Study of the Evolution of Topology in Nanoporous Metal Sponges</td>
</tr>
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</table>

1100 – 1230
Resolving the Orientation and Morphology of Ultra-Fine Precipitates Using Atom Probe

Conventionally, resolving the orientation and morphology of ultrafine high-field precipitates using atom probe is very challenging due to the so-called local magnification effect. In this presentation we present a novel technique to solve the problem.

Don Price
CSIRO Materials Science and Engineering NSW AUSTRALIA

Structural Health Monitoring of Space Vehicle Thermal Protection Systems: Material Properties

Ultrasonic measurements have been made on a thermally-insulating ceramic foam material. The elastic constant tensor deduced indicates extreme anisotropy that is shown to have significant consequences for echolocation of potentially damaging impacts.

Trevor Finlayson
University of Melbourne VIC AUSTRALIA

Stresses in Inclusions Resulting from Plastic Flow in the Matrix of a Two-Phase Composite During Cyclic Loading

Stresses in the Si particles of an Al7Si-0.4Mg casting were measured by neutron diffraction, in samples cyclically strained to +/-2% at 130 deg C. The results are compared with theories of stress partitioning in metal-matrix composites.

Klaus-Dieter Liss
Australian Nuclear Science and Technology Organisation NSW AUSTRALIA

Metals Behavior at Very High Temperature

The kinetic behavior on crystal perfection in metals at high temperature has been studied with neutron and high-energy synchrotron X-radiation. Dislocation annihilation, nucleation and growth mechanisms, and thermo-mechanic deformation mechanisms are obtained from the in-situ and real-time observations.

1100 – 1130

Andrew Cleland
University of California UNITED STATES OF AMERICA

Quantum Light and Sound for Fun and Computation

I will describe using a superconducting qubit to probe the quantum behaviour of electromagnetic ("light") and mechanical resonators ("sound"), and briefly describe how these provide the basic building elements for a quantum computer.

1130 – 1145

Timothy Duty
University of New South Wales NSW AUSTRALIA

Parametric Down-conversion of Microwave Photons Using Superconducting Quantum Devices

The strong nonlinearity provided by superconducting Josephson tunnel junctions can be used in experiments for parametric down conversion of microwave photons, and has many potential uses for nanoscale engineered quantum systems. I will describe experiments where parametric driving is implemented using a superconducting quantum interference device (SQUID), with one example being observation of the dynamical Casimir effect (DCE).

1145 – 1200

John Hornibrook
University of Sydney NSW AUSTRALIA

Superconducting Resonators with Parasitic Electromagnetic Environments

Parasitic electromagnetic fields are shown to decrease the Quality factor of superconducting resonators. Low temperature measurements and numerical simulations are presented, demonstrating an increase in loaded Quality factor as parasitic fields are suppressed.

1200 – 1215

Timothy Dubois
RMIT University VIC AUSTRALIA

Delocalised Oxygen as the Origin Of Strongly Coupled Two-level Defects in Josephson Junctions

Decoherence is a major limitation for Josephson junction based quantum devices, which stefrom environmental two-level systems. Using atomic positions and species we compute experimentally observed parameters of these defects, finding excellent agreement with experiments.
Warrick Farr  
University of Western Australia WA AUSTRALIA

**Behaviour of the Fe3+ Paramagnetic Ion in Sapphire Whispering Gallery Mode Resonator at mK Temperatures Under DC Magnetic Field**

We measure properties of a sapphire whispering gallery mode (WG) resonator by measuring the interaction between the WG mode and the Fe3+ electron spin resonance under the influence of a DC magnetic field.

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1100 – 1230

**Concurrent Session 4D – Atomic and Molecular Physics 4: Cold Ato/ BEC**

**Room:** CLB 5  
**Chair:** Charles Clark, National Institute of Standards and Technology (NIST), GAITHERSBURG, USA

**1100 – 1115**  
Philip Light  
University of Western Australia WA AUSTRALIA

**Cold Atom Imaging with a Polarisation Interferometer**

We propose and demonstrate phase imaging of a cold-atom cloud using a polarisation interferometer. The technique provides straightforward retrieval of phase-shift and absorption experienced in the probe arm of the interferometer.

**1115 – 1130**  
Stephen Gensemer  
University of Sydney NSW AUSTRALIA

**Direct Observation of Resonant Scattering Phase Shifts and their Energy Dependence**

We have observed the influence of scattering resonances on the collisional phase shift in ultracold atom-atom scattering with a novel technique for direct measurement of quantum scattering phase shifts.

**1130 – 1145**  
John McFerran  
University of Western Australia WA AUSTRALIA

**A Neutral Mercury Optical Lattice Clock**

We report on the first operation of a Hg optical lattice clock, producing an absolute frequency measurement with mid-$10^{-15}$ range systematic uncertainty and low $10^{-16}$ range statistical uncertainty.

**1145 – 1200**  
Andrew Horsley  
University of Basel SWITZERLAND

**Microwave Field Imaging Using Atoms**

We are developing a sensitive, high-resolution and frequency-tunable technique for the imaging of microwave magnetic fields. Both ultracold and hot atomic vaposures have been successfully used to completely reconstruct microwave fields, including phase.

**1200 – 1215**  
Stuart Szigeti  
Australian National University ACT AUSTRALIA

**Precise Manipulation of a Bose-Einstein Condensate’s Wavefunction**

We present a scheme, based upon radiofrequency (RF) resonance and magnetic field gradients, that can be used to apply arbitrary spatially-dependent phase shifts to the BEC order parameter at the healing-length scale.

**1215 – 1230**  
Chris Bradly  
University of Melbourne VIC AUSTRALIA

**Coherent Tunnelling via Adiabatic Passage in a Three-Well Bose-Hubbard System**

We employ the Bose-Hubbard model to investigate the adiabatic transport of particles across a three-well chain without occupation of the middle well, and compare to mean-field results.

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**1100 – 1230**

**Concurrent Session 4E – Nuclear and Particle Physics 4**

**Room:** CLB 4  
**Chair:** Gregory Lane, Australian National University, ACT AUSTRALIA

**1100 – 1130**  
Andrew Stuchbery  
Australian National University ACT AUSTRALIA

**Free Ion Hyperfine Fields and Magnetic Moment Measurements on Radioactive Beams**

Recent magnetic-moment measurements on neutron-rich nuclei produced as radioactive beaare discussed. The focus is on the recoil in vacuum technique, which makes use of the intense hyperfine fields of highly charged free ions.
1130 – 1145  **Pere Rados**  
*University of Melbourne VIC AUSTRALIA*  
A Standard Model Higgs Boson Search in the H -> WW Decay Mode in ATLAS  
A search for the Standard Model Higgs boson produced in association with a W boson and decaying to a pair of W bosons which decay leptonically is presented, based on 2011 data from the ATLAS detector.

1145 – 1200  **Tibor Kibedi**  
*Australian National University ACT AUSTRALIA*  
The Pair Decay of the 7.654 MeV State in $^{12}$C  
A new pair spectrometer is being developed at the ANU to observe the electron-positron pair emission from the decay of the Hoyle state at 7.654 MeV in $^{12}$C.

1200 – 1215  **Michael Tobar**  
*University of Western Australia WA AUSTRALIA*  
Testing the Standard Model of Particle Physics at Parts in $10^{18}$, Using Rotating Cryogenic Sapphire Oscillators  
Since the early 2000s we have been using cryogenic sapphire resonators to test the Standard Model of Particle Physics through Lorentz Invariance experiments in collaboration with LNE-SYRTE at the Paris Observatory, Harvard and Humboldt University.

1215 – 1230  **Asif Ahmed**  
*Australian National University ACT AUSTRALIA*  
Time-Dependent Recoil in Vacuum – Improved Sensitivity to Hyperfine Fields and Nuclear Moments  
Motivated by applications to nuclear moment measurements on radioactive beams, the development of methods to measure the time dependence of the hyperfine fields of free ions recoiling in vacuum will be described.

1100 – 1230  **Concurrent Session 4F – Biophysics 2**  
*Room: CLB 3*  
*Chair: Jamie Vandenberg, University of New South Wales, NSW AUSTRALIA*

1100 – 1130  **Zdenka Kuncic**  
*University of Sydney NSW AUSTRALIA*  
Rolling the Biological Dice: Quantifying Stochastic Gene Expression  
Underpinning all living matter is a complex network of interacting genes and proteins. Over the last decade, experimental studies have revealed that this genetic network is driven by stochastic fluctuations, implying intrinsically non-deterministic cell-to-cell variations in protein levels and hence, cell function and fate. This has far-reaching implications for developmental and indeed evolutionary biology. However, quantitative methods for analyzing and interpreting live cell microscopy data are lacking. We have developed a wavelet analysis approach to gain new insights into noisy gene expression. We show that the wavelet power spectra predicted by a noisy genetic network model can exhibit a bimodal probability distribution, indicative of two dynamical populations interrelated by gaussian noise.

1130 – 1145  **Erik Streed**  
*Griffith University QLD AUSTRALIA*  
Unfolding Single Biomolecules  
The conformational dynamics of biomolecules drives the chemistry of life. We propose trapping single biomolecular ions in a Paul trap to probe their dynamics and that of their surrounding solvent cage.

1145 – 1200  **Michael Startsev**  
*Macquarie University NSW AUSTRALIA*  
PH Gradient Electrofocusing for Proteomics  
Dynamic equilibrium pH gradient protein electrofocusing was demonstrated on a fused silica nanofluidic device. R-Phycoerythrin concentration was achieved in narrow bands (3.1±4μm) within the nanochannels at concentration enhancement factors of 320 within 5 minutes. within the nanochannels at concentration enhancement factors of 320 within 5 minutes.

1200 – 1215  **William Brown**  
*Swinburne University of Technology VIC AUSTRALIA*  
Mechanism of Infrared Neural Stimulation of Murine Auditory Neurons in Vitro  
Despite recent progress, the detailed mechanism of infrared neural stimulation (INS) remains controversial. In vitro studies of INS in murine auditory neurons suggest that both capacitance changes in the cell membrane and heat sensitive ion channels play a role.
1215 – 1230  
**Maher Elbohouty**  
*University of Waikato NEW ZEALAND*  
Methodology to Measure the Electrical Conductivity of Seizing and Non-Seizing Mouse Brain Slices  
We present two methods for measuring electrical conductivity of (2 mm x 2 mm x 0.4 mm) living sections of cerebral cortex. We have successfully measured the electrical conductivity in seizing and non-seizing conditions.

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1100 – 1230  
**Concurrent Session 4G – ACOFT 4 Photonics in Action**  
*Room: CLB 2*  
Chair: Andrew Ellis, University College Cork, IRELAND

**Time**  
1100 – 1130  
**Peter Ferris**  
*National Broadband Network ACT AUSTRALIA*  
*Professor Peter Ferris is supported by CUDOS*  
**NBN Network Design**  
Three key elements of the NBN Co Network Design will be explored in this presentation:  
1. What: the structure and the design method for the fibre Customer Access Network (CAN) replacing the twisted pair copper in Australia’s Telecommunications’ access network.  
2. Where: the method used in determining where the fibre access network is to be installed.  
3. When: the scheduling algorithm used to determine the order of deployment of the network.

1130 – 1200  
**Andre Luiten**  
*University of Western Australia WA AUSTRALIA*  
**From Boolardy to Brisbane: Accurate Time and Frequency for the Nation**  
We report on the key components for building a continental-scale time and frequency dissemination system. The information will be carried on the AARNet fiber network and can support activities in radio astronomy, geodesy and measurement science.

1200 – 1230  
**Daniel Shaddock**  
*Australian National University ACT AUSTRALIA*  
**Fibre Sensing Techniques Adapted from Gravitational Wave Detection**  
The field of gravitational wave detection has driven improvements in the sensitivity of optical interferometry. Recently, several of these techniques have been adapted to improve the performance of fibre sensors.

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1100 – 1230  
**Concurrent Session 4H – Industry 1**  
*Room: CLB 1*  
Chair: Cathy Foley

**Time**  
1100 – 1130  
**Will Monks**  
*Monks IP*  
**Patenting 101**  
An overview of the types of Intellectual Property, the benefits of patenting, what types of subject matter can be patented, the patent process and costs, and some key trapdoors.

1130 – 1200  
**Maryanne Large**  
*Canon Information Systems Research Australia NSW AUSTRALIA*  
**Canon Information Systems Research Australia**  
Dr. Large will discuss the differences in approach and priorities in academia and industry and some of the current impediments to commercialisation in Australia.

1200 – 1215  
**Warren McKenzie**  
*Australian National Fabrication Facility*  
**ANFF: Delivering Scientific Innovation from the Lab to Australian Industry**  
The Australian National Fabrication Facility has a track record of enabling industry to use new science for their innovation. A number of case studies illustrate the benefits of ANFF to Australian industry.
1215 – 1230  Scott Martin
CSIRO
Ask Not What Industry Can Do For You
The seminar will present some contrasting approaches to forging connections between research and commercialisers, manufacturers and end-user group - it will include examples from experience at CSIRO.

1330 – 1500

Concurrent Session 5A – Optics, Photonics and Lasers 5: Lasers 2 and Laser Applications
Room: CLB 7
Chair: Lap Van Dao, Swinburne University of Technology, VIC AUSTRALIA

Time  
1330 – 1400  Donna Strickland
OSA President, University of Waterloo CANADA
Studying the Spectra of the Individual Orders Produced by Transient Multi-frequency Raman Generation
Multi-frequency Raman generation efficiently generates a large number of Raman orders. The spectra of the individual Raman orders are studied as a function of dispersion, pump intensity, pulse chirp, and frequency detuning.

1400 – 1415  Ondrej Kitzler
Macquarie University NSW AUSTRALIA
Continuous Wave, 10 W External Cavity Raman Laser: Experiment and Modeling
We present an experimental and analytical study of the performance of a continuous-wave diamond Raman laser in external-cavity setup operating at 10 W. We discuss the effects of thermal loading on further power scaling.

1415 – 1430  Aaron McKay
Macquarie University NSW AUSTRALIA
Efficient High-Power (>10 W) Pulsed Diamond Raman Laser Operation in the Eye-Safe Region
We report a nanosecond-pulsed 2nd-Stokes external-cavity diamond Raman laser operating in the eye-safe region with more than 10 W of average output power and slope efficiencies approaching that of the quantum conversion limit.

1430 – 1445  Joshua Toomey
Macquarie University NSW AUSTRALIA
Mapping Instabilities in VCSEL Nonlinear Dynamics
High resolution dynamic maps of the output from nonlinear laser system are now achievable from computer controlled experimental characterization. Here-in mapping tools are researched that detect regions of operation where the nonlinear dynamics are unstable.

1330 – 1500

Concurrent Session 5B – Condensed-Matter, Materials and Surface Physics 5: Optical and Meta-materials
Room: CLB 8
Chair: Olivia Samardzic, Defence Science and Technology Organisation, VIC AUSTRALIA

Time  
1330 – 1345  Ilya Shadrivov
Australian National University ACT AUSTRALIA
Light-Tunable Metamaterial Mirror
We introduce an original approach for creating light-tunable electromagnetic metamaterials. We design and study the metamaterial mirror, which can dynamically manipulate reflected waves. We demonstrate that our mirror can steer, focus and defocus electromagnetic beams.

1345 – 1400  Mikhail Lapine
University of Sydney NSW AUSTRALIA
Anisotropic Metamaterials with Broadband Diamagnetic Response
We present a detailed analysis of the diamagnetic response which emerges in anisotropic stacks of densely packed conductive rings. We show how the effective permeability of the corresponding metamaterial is controlled by the structure parameters.
Comparative Study on Electrical and Optical Properties of Random and Aligned Metal Nanowire Networks as Transparent Electrodes for Optoelectronic Devices

Shouyi Xie
Swinburne University VIC AUSTRALIA

The optical and electrical properties of three major types of metal nanowire networks, random mesh with circular wires, orthogonal mesh and gratings with rectangular wires were investigated as transparent electrodes in this paper.

Simulations of Local Plasmon Modes of Cuboids

Matthew Arnold
University of Technology Sydney NSW AUSTRALIA

The evolution of local plasmon modes of cuboids is investigated using the boundary element method. Sharp edges increase field concentration, and mode symmetry determines radiative character.

Structure Studies of Flux and Hydrothermally Grown Nonlinear Optical Material KBe2BO3F2

Maxim Avdeev
Australian Nuclear Science and Technology Organisation NSW AUSTRALIA

Different structures of R32 and R-3c have been identified for the deep-UV nonlinear optical single crystals of KBe2BO3F2 (KBBF), fabricated by flux and hydrothermal methods respectively, by single crystal and powder X-ray and neutron diffractions.

Photochromism and the Origin of Colouration in Natural Pink Diamond

Keal Byrne
University of Western Australia WA AUSTRALIA

Natural pink diamond exhibits a stable, optically reversible photochromism that is attributed to an unknown colour centre. We exploit this phenomenon, among other techniques, aiming to determine the structure and properties of this defect.

1330 – 1500

Concurrent Session 5C – Quantum Information, Concepts and Coherence 5: Quantum Information Theory

Room: CLB 6

Chair: Stephen Bartlett, University of Sydney NSW AUSTRALIA

New Physics in Two Dimensions: Braiding Interactions of Anyons

Gavin Brennen
Macquarie University NSW AUSTRALIA

We investigate the non-equilibrium physics of anyons in structured and random topological environments. Quite distinct behaviour is found between Abelian and non-Abelian models and could be exploited to observe and control these systems.

Low Depth Quantum Circuits for Ising Models

Mauro Cirio
Macquarie University NSW AUSTRALIA

A scheme for measuring complex temperature Ising partition functions is introduced. Several applications exploiting the well known relation between time evolution in quantum mechanics and classical statistical models are then presented.

Universal Topologically Protected Adiabatic Cluster State Quantum Computation

Courtney Brell
University of Sydney NSW AUSTRALIA

We define generalized cluster states based on the quantum double of a finite group. Using these states, we propose an adiabatic protocol for universal quantum computation that takes advantage of topological fault-tolerance techniques.

A 2D Quantum Walk Simulation of Two-Particle Dynamics

Peter Rohde
Macquarie University NSW AUSTRALIA

We present an optical implementation of a quantum walk on a two-dimensional lattice. The experiment provides a test-bed for studying entanglement and two-particle dynamics.

Measuring Detector Proximity with Acceleration-Assisted Entanglement Harvesting

Nicolas Menicucci
University of Sydney NSW AUSTRALIA

Entanglement harvested from a quantum field by local interaction with detectors undergoing anti-parallel acceleration can be used to measure the distance of closest approach between the two detectors.
1330 – 1500

Concurrent Session 5D – Atomic and Molecular Physics 5: Scattering Dynamics
Room: CLB 5
Chair: Igor Bray, Curtin University, PERTH, AUSTRALIA

Time
1330 – 1400
Jim Williams
University of Western Australia WA AUSTRALIA
Topological Phase in Spin Polarised Electron Exchange Excitation of an Atom
The observation of a non-zero StokesP2 parameter, of the radiation emitted during spin exchange excitation of a single atom, is interpreted as evidence of a geometric Berry phase.

1400 – 1415
Prasanga Palihawadana
Australian National University ACT AUSTRALIA
Electron and Positron Scattering from Pyrimidine Compared with Other Biological Analogs
Electron and positron scattering cross sections from pyrimidine are presented together with a comparison to other biological analogs.

1415 – 1430
Joshua Machacek
Australian National University ACT AUSTRALIA
Low-Energy Positron Scattering From Molecular Hydrogen
Molecular hydrogen is the simplest, stable neutral molecule. It is therefore the prototypical target for positron-molecular chemistry. We present positron scattering experiments; measuring positronium formation, total elastic and total inelastic scattering cross sections below 200eV.

1430 – 1445
James Calvert
Griffith University QLD AUSTRALIA
The Interaction of Ultrafast Light Pulses with Exotic Atoms
Neon ions from the interaction of metastable neon and 6fs laser pulses are detected using a reaction microscope, enabling the resolution of ionization mechanisms. We will report results of preliminary experimental investigations of these processes.

1445 – 1500
Ilkhom Abdurakhmanov
Curtin University WA AUSTRALIA
C6+ – Impact Fully Differential Ionisation of Helium in the Coplanar and Perpendicular Planes
A recently developed fully quantum-mechanical convergent-close-coupling (CCC) approach is applied to calculate in- and out-of-plane triple differential cross sections for single ionization of helium by C6+ projectile at impact energy of 100 MeV/amu.

1330 – 1500

Concurrent Session 5E – Nuclear and Particle Physics 5
Room: CLB 4
Chair: Martin Sevior, University of Melbourne, MELBOURNE, AUSTRALIA

Time
1330 – 1400
Archil Kobakhidze
University of Sydney NSW AUSTRALIA
Theoretical Implications of the LHC Resonance at 125-126 GeV
Theoretical implications of the 125-126 GeV resonance recently discovered at CERN LHC are discussed with particular emphasis on vacuum stability, naturalness and possible physics beyond the Standard Model.

1400 – 1415
Ian Carter
Australian National University ACT AUSTRALIA
Determination of the Angular Distribution of Evaporation Residues Following Transmission through the Superconducting Solenoidal Separator SOLITAIRE
An investigation into two methods developed at the ANU that extracts the Evaporation Residues angular distribution in the superconducting solenoid. Accurate knowledge of this distribution is a critical step in the determination of absolute fusion cross-sections.
1415 – 1430  
**Iason Baldes**  
*University of Melbourne VIC AUSTRALIA*  
**Radiative Inverse Seesaw Models and Baryogenesis**  
We examine two radiative inverse seesaw models which explain neutrino masses with TeV scale physics and also incorporate dark matter candidates. We examine compatibility with baryogenesis and possible experimental signatures.

1430 – 1445  
**Nyaladzi Palalani**  
*Australian National University ACT AUSTRALIA*  
**Structure of Tantalum Nuclei Beyond the Line of Stability**  
Excited states in neutron-rich tantalum isotopes ($A > 183$) have been studied with deep-inelastic reactions. New structures in this isotopic chain have been identified and the corresponding intrinsic and collective states characterized.

1445 – 1500  
**Amelia Brennan**  
*University of Melbourne VIC AUSTRALIA*  
**Neutrino Signals from Electroweak Bremsstrahlung in Solar WIMP Annihilation**  
We study a WIMP model where the natural helicity suppression of the annihilation rate is lifted by the bremsstrahlung of electroweak bosons, and calculate the neutrino spectra arising from solar WIMP annihilation.

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1330 – 1500  
**Concurrent Session 5F – Biophysics 3**  
Room: CLB 3  
Chair: Martin Carolan, University of Wollongong, NSW AUSTRALIA

**1330 – 1400**  
**Michael Lerch**  
*University of Wollongong NSW AUSTRALIA*  
**Potential Treatment of Radioresistant Tumours Using Synchrotron Generated X-Ray Microbeams**  
Synchrotron submillimeter radiosurgery, using synchrotron generated X-rays, is a new form of cancer treatment being developed for inoperable and otherwise untreatable brain tumours. This talk focuses will discuss the international effort to bring this exciting treatment modality to Australia.

**1445 – 1500**  
**Ranganathan Prabhakar**  
*Monash University VIC AUSTRALIA*  
**Navigating Near Walls at Zero Reynolds Number with Flagellar Propellers**  
The hydrodynamics of a flagellum-propelled microscale swimmer near a boundary are investigated. Stokesian dynamics simulations are used to elucidate the role of directional switching in flagellar rotation in cell steering near a wall.
**Concurrent Session 5G – ACOFT 5 Photonic Sensing 1**

*Room: CLB 2*

**Chair:** David Sampson, University of Western Australia, WA AUSTRALIA

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**Time**

**1330 – 1400**

**Michel Digonnet**

*Stanford University STANFORD USA*

*Sub-Picostrain Sensors Using Slow Light in Fiber Bragg Gratings*

We describe ultra-sensitive strain sensors utilising slow-light resonances at the band edge of strong, low-loss fiber Bragg gratings fabricated with ultrafast pulses. A record resolution of 280 fe/Hz at 23 kHz is reported.

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**1400 – 1415**

**John Arkwright**

*CSIRO NSW AUSTRALIA*

*A Low Profile Fibre Optic Force Sensing Tape for Monitoring Pressures Under a Compression Bandage*

A low profile fibre optic force sensor based on two draw tower grating arrays is presented. The sensor arrays are contained within a low profile tape suitable for monitoring pressures underneath compression garments.

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**1415 – 1430**

**Brendan Kennedy**

*University of Western Australia WA AUSTRALIA*

*Microscopic Imaging of the Mechanical Properties of Breast Tumour Margins Using Optical Coherence Elastography*

We present results of optical coherence elastography (OCE) imaging of excised tumour margins using a customized portable 3D-OCE system. This technique provides microscopic spatial resolution and has the potential to improve tumour margin identification.

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**1430 – 1445**

**Roman Kostecki**

*University of Adelaide SA AUSTRALIA*

*Fabrication of Suspended and Exposed Core Silica Fibres for Sensing Applications*

We report on the fabrication of both enclosed and exposed suspended-core silica microstructured optical fibres. Both the fibre loss and environmental stability are characterised when exposed to some typical sensing and storage environments.

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**1445 – 1500**

**Kevin Cook**

*University of Sydney NSW AUSTRALIA*

*Regenerated Gratings in Helium-loaded Optical Fibre*

We demonstrate regeneration of optical fibre Bragg gratings loaded with inert helium. The gratings survive ultra-high temperatures of up to 1200 °C for extended time periods. The inert nature of He excludes models centred around simple chemical reactions with hydrogen and instead demonstrates the role of glass relaxation.

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**Concurrent Session 5H – Industry 2**

*Room: CLB 1*

**Chair:** Cathy Foley

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**Time**

**1330 – 1400**

**Doron Ben-Muir**

*Commercialisation Australia AUSTRALIA*

Abstract summary not available at the time of print

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**1400 – 1430**

**Lyndon Edwards**

*Australian Nuclear Science and Technology Organisation NSW AUSTRALIA*

*What Physics Can Do for the Engineering Industry*

Abstract summary not available at the time of print

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**1430 – 1500**

**Peter Fisk**

*National Measurement Institute*

*The New SI: Why We Need It, What It Might Look Like, and What It Means for Users*

The talk will discuss aspects and consequences of the proposal to redefine the SI system of units in terms of invariant constants. The redefined system is commonly referred to as the “New SI”.
1530 – 1700


Room: CLB 7
Chair: Peter Drummond, Swinburne University of Technology, HAWTHORN, AUSTRALIA

Time
1530 – 1600
Peter Knight
Imperial College LONDON UK
Quantum Technology for a Networked World
Quantum technologies which depend on atomic coherence will be described with particular emphasis on applications to next generation atomic clocks

Dominic Berry
Macquarie University NSW AUSTRALIA
Universality of the Heisenberg Limit
We prove a rigorous form of the Heisenberg limit for arbitrary phase measurement schemes, provided that there is no additional phase information given. This result rules out the possibility of super-Heisenberg measurements.

Matthew Broome
University of Queensland QLD AUSTRALIA
Direct Characterisation of a Linear Optical Network
We present an efficient method for characterizing passive linear optical networks of phase shifters and beam splitters. The technique employs single- and two-mode coherent states and can be used to reliably predict non-classical dynamics.

1630 – 1700

Concurrent Session 6B – Condensed-Matter, Materials and Surface Physics 6: Positrons and Nanoscience

Room: CLB 8
Chair: Stephen Buckman, Australian National University, ACT AUSTRALIA

Time
1530 – 1600
Anita Hill
CSIRO VIC AUSTRALIA
What Positrons Can Contribute to Materials Physics
Nanostructured materials are emerging as the most efficient materials for use in molecular separations technology due to the ability to tailor the porosity to optimize transport. Porosity in membrane materials can be examined using positrons.

Eric Vance
Australian Nuclear Science and Technology Organisation NSW AUSTRALIA
Positron Annihilation and Electron Microscopy of Off-Stoichiometric Zn$_2$TiO$_4$
While cation vacancies are regarded as the charge compensators in Ti-rich Zn$_2$TiO$_4$, or Ta-doped Zn$_2$TiO$_4$ samples targeted to contain cation vacancies, no evidence of such vacancies was evident from positron annihilation lifetime spectroscopy.

David Sprouster
Australian National University ACT AUSTRALIA
PALS-based Characterisation of Defect Structures in F-implanted Germanium
We present positron annihilation lifetime spectroscopy results pertaining to the thermal evolution of vacancy related defects in F-rich Ge. We find that F enriches the Ge matrix with various vacancy-like clusters that inhibit recrystallization.

Paul Guagliardo
University of Western Australia WA AUSTRALIA
Positron Annihilation Studies of Materials
Positron annihilation has been used to study a range of materials and defect types, from metals and semiconductors containing point defects, to mesoporous insulators containing pores, cages and channels as part of their structure.
1645 – 1700  **Christopher Garvey**  
Australian Nuclear Science and Technology Organisation NSW AUSTRALIA  
**Comparative X-ray and Raman Study of Cellulose Texture and Nanostructure in Wood**  
Nanoscale arrangements of the cellulosic component in wood are mapped onto sections of wood with polarized Raman spectroscopy and x-ray scattering.

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### 1530 – 1700

**Concurrent Session 6C – Quantum Information, Concepts and Coherence 6: Quantum Foundations**  
Room: CLB 6  
Chair: Howard Wiseman, Centre for Quantum Dynamics, QLD AUSTRALIA

**Time**  
**1530 – 1545**  
**Marcelo Pereira De Almeida**  
University of Queensland QLD AUSTRALIA  
**Verifying Quantum Measurements with Discord**  
Quantum discord provides a computational advantage even in the absence of entanglement. Here we demonstrate this advantage in a quantum information task and show that mixed states can be used to verify quantum measurements.

**1545 – 1600**  
**Martin Ringbauer**  
University of Vienna AUSTRIA  
**Quantum Discord as Resource for Remote State Preparation**  
We provide an operational interpretation to quantum discord by relating it to remote state preparation. We further show that entanglement can be misleading and does not qualify as a distinctive resource for this task.

**1600 – 1615**  
**Dylan Saunders**  
Griffith University QLD AUSTRALIA  
**Local Non-realistic States Observed via Weak Tomography – Resolving the Two-slit Paradox**  
We present experimental observation of local non-realistic states via weak tomography, implemented using a single photon entangling gate. This offers a resolution of the two-slit paradox, albeit by introducing observable non-real states.

**1615 – 1630**  
**Cyril Branciard**  
University of Queensland QLD AUSTRALIA  
**How Well Can One Jointly Measure Two Incompatible Observables on a Given Quantum State?**  
We consider the approximate joint measurement of two incompatible observables on a given quantum state, and present an optimal relation for the trade-off between the noise on one observable and the noise on the other.

**1630 – 1645**  
**Michael Hall**  
Griffith University QLD AUSTRALIA  
**Entanglement Verification When Alice and Bob Can’t Be Trusted**  
Entanglement between two parties can be verified for all entangled states even when a referee does not trust the parties or their apparatuses.

**1645 – 1700**  
**Joel Wallman**  
University of Sydney NSW AUSTRALIA  
**Non-negative Subtheories and Quasiprobability Representations of Qubits**  
Negative probabilities are interpreted as indicating nonclassicality, but depend upon the particular quasiprobability representation. We completely classify the sets of qubit bases that can be nonnegative and be permuted by a nontrivial unitary group.

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### 1530 – 1700

**Concurrent Session 6D – Atomic and Molecular Physics 6: Theory**  
Room: CLB 5  
Chair: James Sullivan, Australian National University ACT AUSTRALIA
Quantum Chaos, Statistical Theory of Finite System and Enhancement of Electron Recombination

In an atom with several excited electrons the eigenstates are chaotic superpositions of large number of Hartree-Fock configurations. We developed statistical theory to calculate matrix elements between the chaotic many-body eigenstates. Applications include calculations of electron resonance recombination with highly charged ions which may be enhanced 1000 times (in agreement with experiments).

Simulating Quantum Effects of Cosmological Expansion Using a Static Ion Trap

We propose an experimental testbed that uses ions in the collective ground state of a static trap for studying the analog of quantum-field effects in cosmological spacetimes.

Electric Dipole Moment Enhancement Factor of Thallium

The goal of this work is to resolve the present controversy in the value of the electric dipole moment (EDM) enhancement factor of Tl. We have carried out several calculations by different high-precision methods.

Partial Taylor Relaxation in Solar and Laboratory Plasmas

We apply the theory of partial Taylor relaxation to recent experimental results in the Reversed-Field Pinch, and scope the potential application to nonlinear force-free fields for modeling the solar corona.
1630 – 1645 **David Netherway**  
Department Science and Technology Organisation SA AUSTRALIA  
Spatial and Temporal Detection of Sporadic E in Backscatter and Oblique Incidence Sounders  
Here we report on spatial and temporal distribution of sporadic E as detected simultaneously by backscatter ionospheric sounders and a network of oblique incidence ionospheric sounders.

1645 – 1700 **Zahra Bouya**  
Bureau of Meteorology NSW AUSTRALIA  
An EOF Based Regional Climatological Model of TEC Over Australia  
A climatological regional model for the Total Electron Content over Australia using Spherical Cap Harmonic Analysis (SCHA) and Empirical Orthogonal Function (EOF) techniques.

### 1530 – 1700  
**Concurrent Session 6F – Rheology 1**

**Time**

1530 – 1600 **Mainak Majumder**  
Monash University VIC AUSTRALIA  
Unusual Molecular Transport Properties of Carbon Nanotubes (CNTs)  
The hollow conduit (~ 1 -10 nm diameter) of CNTs has emerged as a model nanofluidic system in which rapid mass transport phenomena has been reported by several research groups. I’ll discuss, rationalize and ask the question is a common thread among these observations? Additionally, I’ll point out future applications in desalination, lab-on-chip devices, gas separations and nanopore sensors.

1600 – 1615 **Roger Tanner**  
University of Sydney NSW AUSTRALIA  
Measuring Viscometric Functions for Non-colloidal Suspensions with Newtonian Matrices  
We present the results of measuring three viscometric functions [the relative viscosity , and the first and second normal stress differences] for monosize sphere suspensions in a silicone fluid, which is nominally Newtonian.

1615 – 1630 **Timothy Nicholson**  
University of Queensland QLD AUSTRALIA  
Factors Affecting The Extrudate Swell For High Density Polyethylene  
A finite element simulation of the extrusion of polyethylene shows that an accurate prediction of the extrudate profile requires good parameterisation of both the viscoelastic and thermal properties of the polymer.

1630 – 1645 **David Konigsberg**  
University of Queensland QLD AUSTRALIA  
The Rheology and Fluid Mechanics of Oscillatory Squeeze Flow  
A new squeeze flow rheometer capable of making on-line measurements of process fluids is investigated through the use of laboratory experiments and finite element simulation.

1645 – 1700 **Elnaz Hajizadeh**  
Swinburne University of Technology VIC AUSTRALIA  
Rheology of Dendrimers and Hyperbranched Polymers Undergoing Planar Elongational Flow  
The extensional melt rheology of dendrimers and hyperbranched polymers has been studied using non-equilibrium molecular dynamics simulation (NEMD). We found that the highly symmetric and constrained topology of these polymers allow for significant differences in their properties compared to the linear polymers.

### 1530 – 1700  
**Concurrent Session 6G – ACOFT 6 Sub-wavelength Photonics**

**Room:** CLB 2  
**Chair:** Francois Ladouceur, University of New South Wales, NSW AUSTRALIA
Recent Progress in Drawn Metamaterials
Using fibre drawing techniques we produce metamaterials with electric and magnetic responses for the terahertz and far-infrared spectrum. The technique is suitable for mass production and can be scaled for operation at optical wavelengths.

Low Loss Coupling to Sub-micron Thin Film Rib and Nanowire Waveguides By Vertical Tapering
Fibre coupling to small mode area high index contrast planar chalcogenide waveguides via vertical tapering of the waveguide film was analysed and experimentally demonstrated. Taper couplers with essentially zero excess loss were demonstrated.

Chalcogenide Glass Photonic Crystal Nanocavity Fully Embedded in an Index-matched Cladding with a High Q-factor (>750,000)
We designed and fabricated a 2-D photonic crystal hetero-structure cavity in the Ge11.5As24Se64.5 chalcogenide glass that is fully embedded in a cladding with refractive index of 1.44. An intrinsic Qv>7.6 x 105 is observed.

Correlated Photon-Pair Generation in a Chalcogenide Ge11.5As24Se64.5 Nanowire
We experimentally demonstrate correlated photon-pair generation in an integrated chalcogenide Ge11.5As24Se64.5 photonic nanowire via spontaneous-four-wave-mixing. Spontaneous Raman scattering acts as the main source of noise and can be mitigated using the characteristic low-Raman window.

Amorphous Silicon Nanowires with High FOM, High Nonlinearity and Good Stability
We demonstrate optically stable amorphous silicon nanowires with both high nonlinear figure of merit (FOM) of ~5 and high nonlinearity Re(γ) = 1200W-1m-1.
Heavy Particles Bound via Higgs Boson Exchange

Heavy particles (fourth generation leptons and quarks, also new heavy bosons) may be bound due to the Higgs boson exchange. We calculate bound states of such particles including relativistic and radiative corrections. We also calculate the decay widths to major channels. Such bound states may be detected at LHC.

Parity of Pions and CP Violation in Neutral Kaon System

It is shown that the mixed-parity nature of pions predicted by the Generation Model indicates that the 1964 CP violating experiment of Christenson et al. may be understood without CP violation.

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Wednesday 12 December 2012

0900 – 0945

Plenary 5

Petra Rudolf
Zernike Institute for Advanced Materials AE NETHERLANDS

Molecular Motors and Switches at Surfaces

Nanometre positional changes in individual molecules by biased Brownian motion triggered by light can collectively cause a change in the macroscopic physical surface properties, for example ultimately leading to transport of a droplet.

0945 – 1030

Plenary 6

Gary Horowitz
University of California THE UNITED STATES OF AMERICA

Surprising Connections between Gravity and Condensed Matter

In addition to describing gravitational phenomena, general relativity can describe aspects of nongravitational physics including condensed matter. I will explain this surprising development and illustrate it by using general relativity to reproduce aspects of superconductivity.

1100 – 1230

Concurrent Session 7A – Optics, Photonics and Lasers 7: Metamaterials

Paul Kinsler
Imperial College London UNITED KINGDOM

Transformation Media in Space and Time: Causality, Cloaks, and Curvature

We present our unification of Transformation Optics with Transformation Acoustics and other wave theories, which allows naturally for spacetime Transformation devices. This is expedited by taking a causality-centric approach from the very start.
1130 – 1145  **Dragomir Neshev**  
**Australian National University ACT AUSTRALIA**  
**Magnetic Quasi-crystal Metamaterials**  
We analyze the effect of lattice symmetries on anisotropy of magnetic metamaterials. We reveal that metamaterials with quasi-crystal structure exhibit strong resonances and weak dependence on incident angle, opening a new path to optical isotropy in metamaterials.

1145 – 1200  **Kokou B Dossou**  
**University of Technology, NSW AUSTRALIA**  
**Semi-Analytic Impedance Modelling of 3D Photonic and Metamaterial Structures**  
We develop a semi-analytic method for modeling the scattering of light by absorbing, three-dimensional, periodic photonic and metamaterial structures. The advantages (in design and intuition) of the formalism are demonstrated through two applications.

1200 – 1230  **Manuel Decker**  
**Australian National University ACT AUSTRALIA**  
**Photoluminescence Enhancement in Magnetic Quantum-Dot Metamaterials**  
We experimentally study PL-enhancement of quantum dots coupled to split-ring-resonator metamaterials. Performing confocal micro-photoluminescence spectroscopy and -mapping, we demonstrate polarization-dependent control of emission via strong interaction between quantum dots and magnetic modes of the metamaterial.

1230-1250  **2012 AOS W.H. (Beattie) Steel Medal Winner**  
**Room: CLB 7**  
**Prof Barry Luther-Davies**  
**Australian National University ACT AUSTRALIA**  
**Nonlinear Optics: Starting and Finishing in the Mid Infrared**  
My research over the past forty or so years has been united by the theme of nonlinear optics, and started in the 1970s with studies of the use of parametric processes for generating tunable mid-IR light. In the intervening years I got interested in nonlinear optics in plasmas, photorefractive nonlinear optics, nonlinear materials and recently as part of CUDOS all-optical signal processing. Right now though I find myself “back” in the mid-IR tackling developing waveguide devices that may finally open up some of the exciting applications of this important spectral region.

1100 – 1230  **Concurrent Session 7B – Condensed-Matter, Materials and Surface Physics 7: Superconductivity**  
**Room: CLB 8**  
Chair: Oleg Sushkov, University of New South Wales, NSW AUSTRALIA

**Time**  
1100 – 1130  **Xiaolin Wang**  
**University of Wollongong NSW AUSTRALIA**  
**Topological Insulators: A New Platform for Novel Spintronics and Superconductivity**  
Materials with zero band gap, namely gapless semiconductors, have unique physical properties compared to conventional semiconductors, insulators and metals. Their band structures are extremely sensitive to external influences such temperature, pressure, electric or magnetic field. Spin gapless semiconductors that bridge the gap between semiconductors and halfmetallic ferromagnets exhibit a band gap in one of the spin channels and a zero band gap in the other and thus allow for tunable spin transport [1,2]. Topological insulators are materials that behave as insulators in their bulk state and metals on their gapless surface states with linear dispersion between energy and momentum. An overview on novel physical properties will be given for some typical zero gap materials with either quadratic or linear dispersion. New physics and potential applications in spintronics, electronics, multiferroics on a number of spin related gapless semiconductors, topological insulators, and other new class of zero gap materials will be addressed. Some experimental data on their fascinating physical properties such as observation of Josephson supercurrent through a topological insulator surface state and room temperature giant magnetoresistance in topological Bi$_2$Te$_3$ nano-sheet will be presented [3,4].

1130 – 1145  **Jared Cole**  
**RMIT University VIC AUSTRALIA**  
**Bistable Defects in Josephson Junction Devices: When Superconducting Circuits Are Not So Super**  
Bistable defects are ubiquitous in superconducting quantum circuits and are a major contributor to decoherence. Experiments on individual strongly-coupled defects have opened up new possibilities for differentiating between the many theories that have been suggested for their origin.
1145 – 1200  Guochu Deng  
Australian National Nuclear Research and Development Organisation NSW AUSTRALIA  
Structure Evolution and Spin Dynamics of Highly Ca-doped Spin Ladder Superconductor Sr_{14-x}Ca_xCu_{24}O_{41}  
The crystal structure and charge distribution and spin dynamics of spin ladder superconductor Sr_{14-x}Ca_xCu_{24}O_{41} have been investigated with the Ca doping content. Superconducting transition was observed under hydrostatic and uniaxial pressure. Inelastic neutron scattering results indicated that the spin gap of the ladder subsystem doesn’t collapse with highly Ca doping, overturning the conclusion from Nexperiments.

1200 – 1215  Yarema Reshitnyk  
University of Queensland QLD AUSTRALIA  
Quantum Noise in a SQUID-Tunable Microchip Resonator  
Nanojunction based SQUID sensors are developed for incorporation into the centre strip of a superconducting coplanar waveguide to make tunable resonators. The current-voltage characteristics and magnetic field modulation of niobium nanobridge-based SQUIDs are presented and optimized using focused ion beam techniques.

1215 – 1230  Alexey V Pan  
University of Wollongong NSW AUSTRALIA  
Practical Superconductors: Measurements and Reality  
We show that practical superconductors respond differently to measurement techniques due to fundamental issues as well as unaccounted phenomena, which considerably affect measured properties of the superconductors and corresponding explanations.

1100 – 1230  Concurrent Session 7C – Quantum Information, Concepts and Coherence 7: Frontiers in Quantum Optics  
Room: CLB 6  
Chair: Gabriel Molina-Terriza, Macquarie University, NSW AUSTRALIA

Time  
1100 – 1130  Howard Wiseman  
Griffith University QLD AUSTRALIA  
Loophole-free Steering for Quantum Cryptography and for Testing the Subjectivity of Atomic Quantum Jumps  
Schrödinger’s “steering” enables 1-sided device independent (DI) quantum key distribution (QKD), which would be far easier to demonstrate than fully DI QKD, and also allows for experiments to test the detector-dependence of atomic quantum jumps.

1130 – 1145  Andrew White  
University of Queensland QLD AUSTRALIA  
Engineering Photonic Quantum Emulators and Simulators  
We discuss our recent results in engineering photonic systefor emulating topological phases of matter, biological phenomena, and simulating computationally-difficult problems.

1145 – 1200  Michael Taylor  
University of Queensland QLD AUSTRALIA  
Biological Measurement Beyond the Quantum Limit  
We demonstrate the first biological measurement to beat the quantum noise limit. Using squeezed light, lipid particles within yeast cells are tracked with sub-shot noise sensitivity. This measurement reveals the viscoelasticity of the cellular cytoplasm.

1200 – 1215  Sheon Chua  
Australian National University ACT AUSTRALIA  
Results from the LIGO Squeezed Light Injection Experiment  
We report on the results of the Australian partnered-international collaborative experiment that successfully injected squeezed light for sensitivity-enhancement into a kilometre-scale laser interferometric gravitational-wave detector, the LIGO Squeezed Light Injection Experiment.

1215 – 1230  Michael Steel  
Macquarie University NSW AUSTRALIA  
Discretely Observable 3D Quantum Walk Structures  
We introduce a family of continuous-time quantum walk devices that permit discrete observation of the quantum statistics and are suited to existing 3D fabrication techniques. The topologies induce novel time-dependent photon correlations.
1100 – 1230

Concurrent Session 7D – Atomic and Molecular Physics 7: Matter Interactions

Room: CLB 5
Chair: Mike Charlton, Swansea University, UNITED KINGDOM

**Time**

1100 – 1130

Ronald White
James Cook University QLD AUSTRALIA

**Positron Transport in Soft-Matter – Biomedical Application**

We present recent developments in the modeling of the transport positron and electron in biological media, with primary application in the fields of positron emission tomography and radiation damage.

1130 – 1145

Emma Anderson
Australian National University ACT AUSTRALIA

**Low Energy Positron Scattering from Uracil**

A low energy, high resolution positron pulsed beam was used to measure positron scattering from uracil between 1 and 200 eV. Total scattering, total elastic scattering and positronium formation cross sections will be presented.

1145 – 1200

Laurence Campbell
Flinders University SA AUSTRALIA

**Nonequilibrium Modelling of Atomic and Molecular Processes in Planetary Atmospheres**

Atomic and molecular processes in planetary atmospheres have a wide range of time scales. A nonequilibrium algorithm is introduced which allows this wide range to be addressed, along with verification and an example application.

1200 – 1215

Ravshanbek Utamuratov
Curtin University WA AUSTRALIA

**Two-Centre Convergent Close-Coupling Calculations of Positron Scattering from Magnesium**

Two-centre convergent close-coupling (CCC) method has been applied to positron scattering from magnesium. The results confirm the existence of a P-wave resonance that has been predicted by previous single-centre methods [3,4] for low energy elastic scattering.

1215 – 1230

Luca Chiari
Flinders University SA AUSTRALIA

**Positron Scattering from Ethene**

Cross section results for low energy positron scattering from ethene are presented. New experimental total cross sections and calculated elastic integral cross sections are compared with earlier measurements and computations on this target species.

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1100 – 1230

Concurrent Session 7E – Solar, Terrestrial and Space Physics 2

Room: CLB 4
Chair: John Humble, University Of Tasmania, TAS AUSTRALIA

**Time**

1100 – 1130

Bo Li
University of Sydney NSW AUSTRALIA

**New Results of Type II and III Solar Radio Bursts**

Latest results of theoretical and numerical modeling of type II and III solar radio bursts are presented. These bursts are produced by electron beamaccelerated at shocks and magnetic reconnection sites on the Sun.

1130 – 1145

Robert Stening
University of New South Wales NSW AUSTRALIA

**Spherical Harmonic Analysis of Geomagnetic Variations**

Magnetic variation data from a worldwide distribution of observatories are subjected to spherical harmonic analysis in order to obtain the equivalent overhead ionospheric current systems. Seasonal and longitude variations of the current systems are examined.
David Farrant
CSIRO NSW AUSTRALIA

Wavelength Matched Etalons for the Solar Orbiter Polarimetric and Helioseismic Imager

We describe the design, fabrication and metrology of ultra-narrowband optical filters (etalons) for the ESA Solar Orbiter satellite mission, including sub-angstrom matching of the passband wavelength.

Matt Francis
IPS Radio and Space Services NSW AUSTRALIA

The Australian Empirical Real Time Regional Ionosphere Model

This talk describes the latest developments towards an empirical real time ionospheric model assimilating data from ionosondes and GPS receivers.

Dave Neudegg
Bureau of Meteorology NSW AUSTRALIA

Significant Events to Date in Cycle 24

Solar Cycle 24 is nearing the maxima of sunspot number and it has provided a range of interesting events and subsequent effects on the geomagnetic field, ionosphere and technologies affected by them.

1100 – 1230
Concurrent Session 7F – Rheology 2

Room: CLB 3
Chair: Timothy Nicholson, University of Queensland, QLD AUSTRALIA

1100 – 1130
Denis Evans
Professor Dennis Evans is supported by Australian Society of Rheology (ASR)

Nonequilibrium Statistical Mechanics Applied to Fluid Rheology

Each of the “Laws” of thermodynamics are now theorems of nonequilibrium statistical mechanics. These “laws” are proved using the laws of mechanics and the axiom of causality. We illustrate these theorems with simulations of a viscoelastic fluid.

1130 – 1145
Elliot Gilbert
Australian National Nuclear Research and Development Organisation NSW AUSTRALIA

Structural Transitions During Starch Pasting: Deducing the Branching Structure of Starch Gels with Small-angle Scattering

Simultaneous neutron scattering and pasting data were obtained from various starches. The scattering patterns indicated mass-fractal structure within the pastes and the degree of branching was deduced with the unified methodology, with interesting botanical variation.

1145 – 1200
Sergio De Luca
Swinburne University of Technology VIC AUSTRALIA

Spin and Linear Momentum Coupling: Generating Steady-State Flow Without Mechanical Pumping at the Nanoscale

We present both theoretical and simulation studies that demonstrate the importance of the non-classical phenomenon of coupling of molecular spin to linear translational momentum, which is a fundamental feature of fluid flow under extreme confinement.

1200 – 1215
Anthony Stickland
University of Melbourne VIC AUSTRALIA

A Hyperelastic Constitutive Approach for the Rheology of Concentrated Particulate Suspensions under Combined Shear and Compression Loads

A hyper-viscoelastic constitutive approach has been developed to describe the flow and deformation of concentrated suspensions. The approach allows for strain and strain-rate dependent bulk shear flow and compressive solid-liquid separation.

1215 – 1230
Ranganathan Prabhakar
Monash University VIC AUSTRALIA

Role of Self-Concentration and Coil-Stretch Hysteresis in Electrospinning of Nominally Dilute Polymer Solutions

Self-concentration of dilute polymer solutions leads to enhanced coil-stretch hysteresis in extensional flows. This sustains large elastic stresses in electrified jets and is thus critical in the control of polymer nanofiber synthesis by electrospinning.
1100 – 1230

Concurrent Session 7G – ACOFT 7 Lasers 1

Room: CLB 2
Chair: Graham Town, Macquarie University, NSW AUSTRALIA

Time

1100 – 1130

David Moss
University of Sydney NSW AUSTRALIA

CMOS Compatible Microcavity Lasers
We demonstrate novel microcavity lasers in an integrated, CMOS compatible platform. This platform has promise for telecommunications and on-chip WDM optical interconnects for computing.

1130 – 1145

Stephanie Crawford
University of Sydney CUDOS NSW AUSTRALIA

Widely Tunable 2.9 ?m Ho3+, Pr3+-Doped Fluoride Glass Fibre Laser Used to Identify 317 cm⁻¹ Raman Shift
A 0.675 W Ho3+, Pr3+ doped fluoride glass fibre laser with 24.4% slope efficiency was tuned between 2.838 and 2.936 μm and used to identify a Raman frequency shift of 317 cm⁻¹ in ZBLAN glass.

1145 – 1200

Alexei Tikhomirov
Defence Science and Technology Organisation SA AUSTRALIA

Splice-Free DFB Fibre Laser Array
We propose and investigate a double-core splice-free fibre laser array with fibre tapers to transmit the light at the pump and signal wavelengths between cores. A two-element monolithic FL array is demonstrated.

1200 – 1215

Michael Oermann
Defence Science and Technology Organisation SA AUSTRALIA

Single-Polarisation DFB Fibre Laser in Photosensitive Ho-doped Fibre
We investigate the enhanced photosensitivity measured in Ho-doped germanosilicate fibres and demonstrate single-longitudinal-mode single-polarisation lasing at 2.13 Å. The laser cavity is formed by fibre Bragg gratings UV-written into the core of the active fibre.

1100 – 1230

Concurrent Session 7H – Joint: Optics, Photonics and Lasers + Condensed-Matter, Materials and Surface Physics (X-ray Optics)

Room: CLB 1
Chair: Klaus-Dieter Liss, Australian Nuclear Science and Technology Organisation, NSW AUSTRALIA

Time

1100 – 1130

Keith Nugent
Australian Synchrotron VIC AUSTRALIA

Coherent X-ray Science, Free-Electron Lasers and Crystallography
X-ray lasers are opening up new frontiers in materials science, biophysics and ultrafast science. I will review coherent X-ray science progress and present some intriguing new results that have emerged from our recent work.

1130 – 1145

Alberto Cereser
La Trobe University VIC AUSTRALIA

Coherent X-rays to shine a light on the Alzheimer’s disease
Fresnel Coherent Diffractive Imaging (FCDI) is a recent microscopy technique applicable at third generation synchrotrons. Combining FCDI with tomography and ptychography we imaged the interior of a yeast cell, a model for neuronal cells.

1145 – 1200

Hannah Coughlan
La Trobe University/CXS VIC AUSTRALIA

Cellular Imaging using Fresnel Coherent Diffractive Imaging
Soft X-ray Fresnel coherent diffractive imaging (FCDI) has been utilised for imaging with high sensitivity, elemental contrast and high spatial resolution. It has long been that contrast between biological components and water is enhanced by using X-rays of energy between the carbon and oxygen absorption edges (2.2 to 4.4 nm). We report initial results obtained in an effort to extend FCDI to this energy range with whole cell samples.
Uwe Klemradt  
**RWTH Aachen University, GERMANY**

**Fluctuations and Avalanches in Diffusionless Phase Transitions Probed by Coherent X-Rays**

Shape memory alloys are based on diffusionless (martensitic) phase transitions. Although most materials undergo fast athermal dynamics, some exhibit superimposed slow phenomena, e.g. ageing. We discuss novel possibilities to investigate such non-equilibrium processes using coherent X-rays.

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**1235 – 1320**

**Women in Physics Session**

**Cathy Foley**  
**CSIRO NSW AUSTRALIA**

**What is the Real Status of Women in Physics in Australia and What Are the Issues Right Now?**

Since some improvements for women in physics up until 2006, there has been a new decline in recent years. Women are underrepresented in all aspects of physics education and work including participation in school, university, and research laboratories. Women physicists usually have lower seniority and earn less. This is compounded by the Australian Institute of Physics Women’s group being inactive since December 2010.

**Susan Feteris**  
**Deakin University VIC AUSTRALIA**

**The Role of Women Academics in Australian Universities**

Women academics have been employed in Australian universities for a century. Why, then, are women so poorly represented at senior levels in our universities? DEEWR statistics show very different environments in Go8 universities, and the others.

**Juna Sathian**  
**Queensland University of Technology QLD AUSTRALIA**

**Female Participation in Tertiary Physics: A Case Study**

A seven-year study has been conducted on female enrolment in physics, from bachelors through to PhD, at QUT. An overall increase in female participation, with the highest percentage increase in research degree has been reported.

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**1330 – 1500**

**Concurrent Session 8A – Optics, Photonics and Lasers 8: Nonlinear Optics 1**

**Room: CLB 7**

Chair: Neil Broderick, University of Auckland, NEW ZEALAND

**Time**

**1330 – 1400**

**Ady Arie**  
**Tel Aviv University ISRAEL**

**Shaping and Twisting Light Beams Using Nonlinear Photonic Crystals**

Recent developments in quadratic nonlinear photonic crystals enable to convert fundamental Gaussian beams to beams of arbitrary shapes by implementing holographic techniques in nonlinear optics. Vortex beams and high order Hermite-Gaussian beams were generated.

**1400 – 1415**

**Yan Sheng**  
**Australian National University ACT AUSTRALIA**

**Randomly Polled Lithium Niobate Crystal for Broadband Optical Frequency Conversion**

We design and fabricate a randomly polled lithium niobate crystal via electric-field poling technique. We show that the randomness enables one to realize an efficient broadband emission of high-quality second harmonic.

**1415 – 1430**

**Richard Neo**  
**University of Sydney NSW AUSTRALIA**

**Phase-sensitive Amplification by Four-Wave-Mixing on a Chalcogenide Waveguide**

We demonstrate for the first time a chip-based phase-sensitive parametric amplifier based on four-wave-mixing within chalcogenide planar waveguide. A peak-to-peak on-chip phase-sensitive gain of 10 dB is observed.
Andrey Sukhorukov
Australian National University ACT AUSTRALIA

Controllable Photon-Pair Generation and Quantum Walks in Nonlinear Waveguide Arrays
We demonstrate experimentally simultaneous photon-pair generation and quantum walks in a nonlinear waveguide array where the output photon correlations can be controlled by varying the pump laser wavelength, switching from classical to quantum statistics.

Diana Antonosyan
Australian National University ACT AUSTRALIA

Effect of Loss on Photon-Pair Generation and Correlations in Nonlinear Waveguide Arrays
We model photon-pair generation through spontaneous parametric down-conversion in quadratic nonlinear waveguide arrays. We study the effect of loss on quantum spatial correlations between photon pairs and determine the tolerance to the loss.

1330 – 1500

Concurrent Session 8B – Condensed-Matter, Materials and Surface Physics 8: Semiconductors-I

Room: CLB 8
Chair: Jodie Bradby, Australian National University, ACT AUSTRALIA

Time
1330 – 1400
Michelle Simmons
University of New South Wales NSW AUSTRALIA

Quantum Computing in Silicon with Donor Electron Spins
We will discuss the recent progress in donor based silicon quantum computation where individual dopant atoms are placed in silicon aligned to epitaxial gate electrodes and charge sensors using scanning probe microscopy.

1400 – 1415
Alex Hamilton
University of New South Wales NSW AUSTRALIA

Nuclear Magnetic Resonance and Hyperfine Coupling in GaAs Electron and Hole Quantum Wires
There is growing interest in the use of hole spins in semiconductor quantum devices to store and process information. We compare the coupling of electron and hole spins with nuclei in the GaAs host crystal.

1415 – 1430
Daisy Wang
University of New South Wales NSW AUSTRALIA

Fabrication and Characterisation of Ambipolar AlGaAs/GaAs Heterostructure Devices
We have fabricated AlGaAs/GaAs heterostructure devices in which the conduction channel can be populated with either electrons or holes. We found significant discrepancies in scattering mechanisms between electrons and holes by comparing experiment to theory.

1430 – 1445
Bianca Haberl
Australian National University ACT AUSTRALIA

A New Crystalline Phase of Silicon Formed from Indentation-Induced High-Pressure Phases
A new crystalline phase of silicon is formed upon thermal annealing of indentation-induced high-pressure phases. This new phase appears unique to indentation and may thus be attributed to the nucleation behaviour under these complex stresses.

1445 – 1500
Adam Burke
University of New South Wales NSW AUSTRALIA

The 1D g-factor and 0.7 Anomaly in QPCs with Independent Control Over Density
We report the dependence of the 1D Lande g-factor g* on electron density in QPCs. We obtain g* values up to 2.8 significantly exceeding previous values for AlGaAs/GaAs QPCs and approaching that in InGaAs/InP QPCs.
1330 – 1500

Concurrent Session 8C – Quantum Information, Concepts and Coherence 8: Optomechanics

Room: CLB 6
Chair: Ping Koy Lam, Australian National University NSW AUSTRALIA

Time
1330 – 1400
Warwick Bowen
University of Queensland QLD AUSTRALIA
Quantum Optomechanics for Sensing and Fundamental Science
Quantum optomechanical systems promise to advance both fundamental science and applications. Here we report quantum control techniques using electric fields and squeezed light, progress towards room temperature operation, and applications in sensing, most particularly magnetometry.

1400 – 1415
David McAuslan
University of Queensland QLD AUSTRALIA
Vibration Stabilisation for Quantum Optomechanics
External vibrations are a significant issue in optomechanics as they introduce an extra source of noise into the system. Here we discuss techniques for reducing the effect of vibrations, and demonstrate a 105 reduction in vibrational noise of a cavity optomechanical system.

1415 – 1430
Glen Harris
University of Queensland QLD AUSTRALIA
Enhanced Micromechanical Sensors: Active Feedback vs Optimal Postprocessing
Thermomechanical noise is a limiting factor in many MEand NEbased sensors. It has been predicted and shown that feedback cooling can enhance force sensing. Here we show the same enhancement can be made with optimal post-processing.

1430 – 1445
Sahar Basiri-Esfahani
University of Queensland QLD AUSTRALIA
Phonon Number Measurements Using Single Photon Opto-Mechanics
We describe a system composed of two optical modes, coupled via a mechanical resonator, and fed by a single photon source. We can engineer phonon number states of the mechanics using successive photon counting conditional measurements.

1445 – 1500
Uzma Akram
University of Queensland QLD AUSTRALIA
Two Photon Conditional Optomechanics
An optomechanical system driven by a single photon is conditioned on long detection times, imparting a large momentum to the mechanics. Consequent delayed injection of a second photon results in a periodic photon router effect.

1330 – 1500

Concurrent Session 8D – Atomic and Molecular Physics 8: Spin

Room: CLB 5
Chair: Brian Orr, Macquarie University, NSW AUSTRALIA

Time
1330 – 1345
Darryl Jones
Flinders University SA AUSTRALIA
Electronic Scattering Phenomena from Radicals of Technological Interest
Progress on the ongoing development of an apparatus for measuring cross sections for electron scattering from radical species will be reported.

1345 – 1400
Andrew Martin
University of Melbourne VIC AUSTRALIA
Measurable Quantum Geometric Phase from a Rotating Single Spin
We show that the internal magnetic states of a single nitrogen-vacancy defect, within a rotating diamond crystal, acquire geometric phases. Under reasonable experimental conditions we show that a phase shift of up to four radians could be measured.
**RF-induced Feshbach Resonances in Rb-87**

Using BEC of Rb-87 atoms on an atom chip we observe a group of predicted RF-induced Feshbach resonances. The frequency and amplitude of the RF field can tune properties of the Feshbach resonances.

**The Role of Spin in Triplet-Triplet Upconversion**

Spectral management of solar radiation via organic sensitized incoherent frequency upconversion is a proven method of boosting photovoltaic efficiencies. Magnetic resonance techniques are used to better understand the spin mixing processes that underlie upconversion.

**Three-atom Collisions in a Dilute Thermal Vapour**

We show experimental and theoretical evidence for significant coherent, multi-atom, laser-induced collisions in fluorescence spectroscopy of a room-temperature Rb vapour.

**Dynamics and Control of Electron Localisation in Dissociating Molecules**

We study the effects of pulse intensity, duration and carrier-envelope phase on asymmetry in hydrogen and deuterium molecular ions dissociated by intense few-cycle near-infrared laser pulses. We compare experimental results with model calculations.

**Concurrent Session 8E – Astronomy and Astrophysics 1: Instrumentation Session**

*Room: CLB 4*

*Chair: Warrick Couch, Swinburne University Of Technology, VIC AUSTRALIA*

**The Australian Square Kilometre Array Pathfinder**

The Square Kilometre Array is an international project to build the world’s most powerful radio telescope. This talk describes CSIRO’s Australian SKA Pathfinder – a highly innovative radio telescope in outback Western Australia, which prototypes a number of unique technologies that will be required for the Square Kilometre Array.

**The H.E.S.S. II Gamma-Ray Telescope – A New Window onto the GeV Gamma-Ray Sky**

The H.E.S.S. II telescope is a ~28 metre diameter Cherenkov imaging telescope designed to study >20 GeV gamma-rays. It will bridge the gap between space and ground-based gamma-ray telescopes and provide high statistics views of gamma-ray bursts, supernova remnants and pulsars.

**Redesign of the Integrated Photonic Spectrograph for Improved Astronomical Performance**

We present the next generation of miniature integrated photonic spectrographs for use in astronomy. These devices have been substantially redesigned to enhance their performance, focusing on high-resolution spectroscopy for planet hunting, and an all-photonics platform.

**Laser Tomography Adaptive Optics System for the Giant Magellan Telescope**

We present the design of the adaptive optics system under development for the Giant Magellan Telescope, including the laser guidestar facility, wavefront sensor, and segment piston sensor.
Silvie Ngo
Australian National University ACT AUSTRALIA

Phasing Concept for Segmented Mirror Telescopes Using Digital Interferometry
A new method for phasing large segmented mirror telescopes is proposed. The technique uses digital interferometry to measure mirror displacements. We describe here the first experiment planned to investigate the technique's performance.

1330 – 1500
Concurrent Session 8F – Complex Systems, Computational and Mathematical Physics 1
Room: CLB 3
Chair: Pulin Gong, University of Sydney NSW AUSTRALIA

Time
1330 – 1400
Peter Robinson
University of Sydney NSW AUSTRALIA

Physical Principles Underlying Complex Brain Network Organisation
Physical limitations arising from stability and geometry are shown to provide strong constraints on brain network architecture, and to account for the main features of such networks, without invoking other principles or imposing ad hoc artificial structures. This underlines the need to consider the physical embedding of networks when analyzing their properties.

1400 – 1415
Evgeny Galakhov and Olga Salieva
Russian Peoples' Friendship University RUSSIAN FEDERATION

Blow-Up Phenomenon For Evolutional Inequalities with Singularities on Unbounded Sets
Many physical phenomena can be described by differential inequalities with singular coefficients. In the present work, necessary conditions of solvability for such inequalities in certain functional classes are established.

1415 – 1430
Ra Inta
Australian National University ACT AUSTRALIA

New Applications of Sparse Methods in Physics
Many problem physics have a level of redundancy, or sparsity, in their formulation. I show here there are useful applications arising from compressive sampling techniques and a recent sparse fast Fourier transform.

1330 – 1500
Concurrent Session 8G – ACOFT 8 Photonic Devices 2
Room: CLB 2
Chair: Mark Withford, Macquarie University, NSW AUSTRALIA

Time
1330 – 1400
Robert Thomson
Herriot Watt University UNITED KINGDOM
Dr Robert Thomson is supported by Professor Joss Bland-Hawthorn (University of Astrophotonics)

Ultrafast Laser Inscription of Integrated “Photonic Lanterns”
We discuss our work on ultrafast laser fabricated integrated “photonic lanterns”. These devices offer exciting possibilities in the field of astrophotonics for efficiently coupling multimode celestial light into single mode devices such as fibre Bragg gratings.

1400 – 1415
Ranjith Rajasekharan Unnithan
University of Melbourne VIC AUSTRALIA

Nanophotonic Phase Modulator
The paper presents the development of an ultra-high resolution nanophotonic phase modulator, where nanotube electrodes are exploited to define pixels in a liquid crystal media.

1415 – 1430
Masood Naqshbandi
University of Sydney NSW AUSTRALIA

Modifying the Contact Angle Of Glass Substrates with Laser Irradiation for Self-Assembly of Photonic Microwire Waveguides
We report on modification of contact angle of glass substrates with water using laser treatment [Arf, λ = 193 nm] both as lines and areas on the substrate surface. Different energies below and above a damage threshold were used. Asymmetric contact angles lead to an improvement in microwire growth.
Design for Broadband On-Chip Isolator Using Stimulated Brillouin Scattering

We present a design for an on-chip photonic isolator with linear response, in which Stimulated Brillouin Scattering is used to induce one-directional mode conversion within a multi-moded chalcogenide (As2S3) rib waveguide.

Relative Intensity Noise of Yb DFB Waveguide Laser Fabricated Using Femtosecond Laser Direct-write Technique

We demonstrate the relative intensity noise (RIN) measurement of a monolithic Yb waveguide laser fabricated by femtosecond laser direct-write technique. The maximum RIN density at the relaxation resonance is -85 dB/Hz at 400 kHz.
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<tr>
<th>Time</th>
<th>Name</th>
<th>Institution</th>
<th>Title</th>
<th>Abstract</th>
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<tbody>
<tr>
<td>1530 – 1600</td>
<td><strong>Heedeuk Shin</strong></td>
<td>Sandia National Laboratories</td>
<td>Tailorable On-chip Stimulated Brillouin Scattering in Nanoscale Silicon Waveguides</td>
<td>We explore the physics of stimulated Brillouin scattering in nanoscale silicon waveguide. With strong lateral photon-phonon confinement, we show forward- and backward-SBS enhanced by a coherent combination of radiation pressures and electrostrictive forces.</td>
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<tr>
<td>1600 – 1615</td>
<td><strong>Yana Izdebskaya</strong></td>
<td>Australian National University</td>
<td>Transformation of Higher-order Spatial Solitons in Nematic Liquid Crystals</td>
<td>We report on the first observation of the transformation of higher-order spatial solitons in nematic liquid crystals, and demonstrate their strong dependence on the geometry of a nonlinear sample.</td>
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<tr>
<td>1615 – 1630</td>
<td><strong>Daniel Leykam</strong></td>
<td>Australian National University</td>
<td>Nonlinear Conical Diffraction in Photonic Lieb Lattices</td>
<td>We study analytically and numerically nonlinear conical diffraction in Lieb lattices and derive an equation for pseudo-spin 1 waves. Conical diffraction distinguishes different pseudo-spin states. Nonlinearity reduces its circular symmetry to four-fold discrete rotational symmetry.</td>
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<tr>
<td>1630 – 1645</td>
<td><strong>James Mills</strong></td>
<td>University of Queensland</td>
<td>Signatures of Integrability Breaking Via Dark-Bright Soliton Collisions in a Two-Component Bose-Einstein Condensate</td>
<td>We study collisions of bright-dark solitons in a two-component Bose-Einstein condensate to shed light on a fundamental problem in physics: how do the constraints of integrability affect the relaxation dynamics of isolated quantum systems?</td>
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<tr>
<td>1645 – 1700</td>
<td><strong>Eugene Gamaly</strong></td>
<td>Australian National University</td>
<td>High-pressure Phase Transformations by Fs-laser in Transparent and Opaque Media</td>
<td>We present studies of phase transformations under extreme pressure generated by intense fs-laser inside sapphire, silicon, olivine, diamond, and demonstrate a novel phenomenon of permanent atoseparation specific to non-equilibrium conditions of confined micro-explosion.</td>
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**Concurrent Session 9B – Condensed-Matter, Materials and Surface Physics 9: Semiconductors-II**

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<tbody>
<tr>
<td>1530 – 1545</td>
<td><strong>Daniel Drumm</strong></td>
<td>RMIT University</td>
<td>Ab Initio Calculation of Si:P Nanowires Confined Atomically in Two Dimensions</td>
<td>The first ab initio calculations of donor structures in silicon, atomically confined both vertically and laterally, have been performed. Bandstructures, valley splitting, effective masses, and the extent of the electronic density are presented.</td>
</tr>
<tr>
<td>1545 – 1600</td>
<td><strong>Adam Micolich</strong></td>
<td>University of New South Wales</td>
<td>Realising Lateral Wrap-gated Nanowire FETs and Controlling Gate Length with Chemistry</td>
<td>We report the first lateral wrap-gated NW-FETs produced using a variant of the well-established methods for fabricating vertical NW-FETs. It enables control over gate length with a single wet etch step with no additional lithography.</td>
</tr>
<tr>
<td>1600 – 1615</td>
<td><strong>Juha Muhonen</strong></td>
<td>University of New South Wales</td>
<td>Influence of Strain to the Electron-phonon Coupling in Degenerately Doped Silicon at Low Temperatures</td>
<td>Strain can be used to modify the electron-phonon coupling in silicon at low temperatures. We have demonstrated this experimentally in degenerately n-doped silicon at temperatures below 0.5 K and used the effect to enhance the cooling phenomenon in superconductor-semiconductor tunnel junctions.</td>
</tr>
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### 1615 – 1630  
**Jodie Bradby**  
*Australian National University ACT AUSTRALIA*

**Measuring the Hardness of Silicon**  
It is well known that silicon undergoes a series of phase transformations during nanoindentation. Measuring the ‘hardness’ of this material using instrumented nanoindentation is thus challenging and raises the interesting question “what is hardness?”.

### 1630 – 1645  
**Leonardus Bimo Bayu Aji**  
*Australian National University ACT AUSTRALIA*

**Structural Relaxation of Ion-implanted Amorphous Silicon**  
The structural relaxation of ion-implanted amorphous silicon (a-Si) has been studied by indentation-induced deformation, Raman microspectroscopy, and electrical conductivity measurement. The maximum a-Si network relaxation is characterized by a minimum bond-angle distortion of 9.4°.

### 1645 – 1700  
**Changyi Yang**  
*University of Melbourne VIC AUSTRALIA*

**Single keV Ion Detection in Silicon**  
Single ion detection in silicon is essential for the implantation fabrication of nano-scaled single donor devices. We address critical issues of the ion-beam-charging-up effect and noise issues associated with wafer-detector handling and the future improvement.

### 1530 – 1700  
**Concurrent Session 9C – Quantum Information, Concepts and Coherence 9: Quantum Theory**  
*Room: CLB 6  
Chair: Gavin Brennen, Macquarie University NSW AUSTRALIA*

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| 1530 – 1545| **Margaret Reid**                            | Swinburne University of Technology VIC AUSTRALIA | **Genuine N-partite Einstein-Podolsky-Rosen Steering**  
We develop the concept of genuine N-partite steering. This nonlocality is realized as a multiparty Einstein-Podolsky-Rosen paradox, and is the key resource for quantum secret sharing. Useful properties emerge not guaranteed for multipartite entangled states. |
| 1545 – 1600| **Daniel Terno**                             | Macquarie University NSW AUSTRALIA          | **Quantum Control in Foundational Experiments**  
We present a framework to analyze quantum controlling devices in experiments in foundations of quantum theory. We illustrate it by a quantum delayed-choice experiment, discuss its implications, present some recent experiments and outline future applications. |
| 1600 – 1615| **Sarah Adlong**                             | Australian National University ACT AUSTRALIA | **Quantum Control of a Bose-Einstein Condensate in a Harmonic Trap**  
Feedback control has been successfully applied to small quantum systems, however, there has been limited application to large systems. An interesting, large quantum system with accessible controls is the Bose-Einstein condensate (BEC). We examine the robustness of previous control schemes to various experimental noise sources, and the accuracy of the approximations used to model the state of the quantum field. |
| 1615 – 1630| **Marcin Zwierz**                            | Griffith University QLD AUSTRALIA           | **Ultimate Limits to Quantum Metrology**  
We give the ultimate formulation of the Heisenberg limit for quantum metrology applicable to all measurement strategies. We prove that this limit holds for the evolutions governed by the generators with an upper-bounded spectrum. |
| 1630 – 1645| **Michael Hall**                             | Griffith University QLD AUSTRALIA           | **Nonlinear Metrology: A Quantum Scaling Paradox**  
Proposed ‘optimal’ nonlinear phase estimation schemes cannot yield more than 1 bit of information per estimate, and their mean square errors cannot beat the Heisenberg limit – a paradox only partially resolved via iterative implementations. |
Open Time-like Curves Violate Heisenberg's Uncertainty Principle

Models of quantum evolution in the presence of closed time-like curves (CTCs) predict unusual information theoretic effects. We show that even CTCs containing no interactions can violate Heisenberg's uncertainty principle for continuous variables.

1530 – 1700
Concurrent Session 9D – Physics Education 1

Time
1530 – 1600
Margaret Wegener
University of Queensland QLD AUSTRALIA
Development of Threshold Learning Outcomes for Australian Graduates in Physics
Academic standards for physics across Australian universities have been collaboratively developed, to aid with emerging regulatory requirements, and to foster good practice in higher education in physics.

1600 – 1615
Les Kirkup
University of Technology NSW AUSTRALIA
Preparing Demonstrators to Facilitate Learning in Inquiry-oriented Practicals
We report an innovation in the professional development of demonstrators which focuses on the student perspective in order to enhance demonstrator s capacity to support learning in inquiry-oriented practicals.

1615 – 1630
Matthew Hill
University of Sydney NSW AUSTRALIA
Can We Test Representational Ability Independent of Physics Conceptual Knowledge?
Multiple representations of information are used in physics teaching and practice. A survey of representational ability, collated and administered to 625 University of Sydney physics students, found representational ability differs from academic ability.

1630 – 1700
Timo Nieminen
University of Queensland QLD AUSTRALIA
Tiered Assessment in Upper-level Undergraduate Physics
Tiered assessment is a differentiated assessment strategy where students can choose to attempt advanced assessment tasks. We discuss the use of tiered assessment in second and third year electromagnetics courses.

1530 – 1700
Concurrent Session 9E – Astronomy and Astrophysics 2: Science Session

Time
1530 – 1545
Tim Bedding
University of Sydney NSW AUSTRALIA
Using Asteroseismology to Probe Stellar Interiors with NASA’s Kepler Mission
Kepler’s observations of oscillations in thousands of stars have led to a revolution in asteroseismology. Key results include detecting gravity modes in red giant stars and characterizing stars found to host exoplanets.
1545 – 1600  
**Aiden Martin**  
University of Technology NSW AUSTRALIA  

**Electron Beam Extraction of Cometary Material from STARDUST Silica Aerogel**  
XeF₂-mediated electron beam induced etching is being developed as a technique for the extraction of STARDUST cometary material from silica aerogel collectors. Methodology, results and application to the study of cometary particles are described.

1600 – 1615  
**Daniel Cotton**  
University of New South Wales NSW AUSTRALIA  

**Carbon Monoxide Distribution Below Venus’ Clouds**  
Carbon Monoxide is an important tracer of atmospheric dynamics and chemistry on Venus. Radiative transfer modelling has been used to interpret observations made of Venus’ lower atmosphere and determine the distribution of carbon monoxide therein.

1615 – 1630  
**Allan Ernest**  
Charles Sturt University NSW AUSTRALIA  

**X-Ray Halos, Dark Gravitational Eigenstates and Cooling Flow**  
Collisions between weakly-coupled baryons in dark-matter gravitational eigenstates will contribute baryons and energy to the visible x-ray halos of galaxies and galactic clusters by redistributing the eigenstate configurations of dark baryons to more-highly-interacting quantum compositions.

1630 – 1645  
**Warrick Couch**  
Swinburne University of Technology VIC AUSTRALIA  

**Identifying the Physical Mechanisms Driving Rapid Galaxy Evolution via Multiwavelength Studies**  
This talk presents the latest results from combining integral field spectroscopy at optical wavelengths with observations taken with the world’s most advanced radio telescopes to understand the physical mechanisms that produce the rapidly evolving E+A galaxies.

1645 – 1700  
**Victor Flambaum**  
University of New South Wales NSW AUSTRALIA  

**Astrophysical Evidences for the Variation of Fundamental Constants and Proposals of Laboratory Tests**  
New results based on the quasar absorption data indicate variation of the fine structure constant $\alpha$ in space. These results are tested in different astrophysical measurements and laboratory experiments with atomic and nuclear clocks. Systems with enhanced effects of the variation may be especially important.

1530 – 1700  
**Concurrent Session 9F – Complex Systems, Computational and Mathematical Physics 2**  
Room: CLB 3  
Chair: Jaan Oitmaa, University of New South Wales NSW AUSTRALIA

1530 – 1600  
**Bruce Henry**  
University of New South Wales NSW AUSTRALIA  

**Fractional Diffusion and Continuous Time Random Walks with Trapping, Forcing and Reactions**  
Fractional diffusion caused by obstacles, traps and crowding is common in physical, biological and financial processes. Mathematical models, including effects from reactions and forcing, are derived from continuous time random walks, fractional calculus and stochastic calculus.

1600 – 1630  
**Alistair Steyn-Ross**  
University of Waikato NEW ZEALAND  

**Critical Slowing in Excitable Systems**  
Excitable systems exhibit a nonlinear increase in sensitivity to stimulus as the threshold for state change is approached. This can be quantified by analyzing the properties of noise-evoked fluctuations, looking for evidence of critical slowing and growing.

1630 – 1645  
**Yusuke Uchiyama**  
University of Tsukuba JAPAN  

**Statistical Characterisation of Hole Turbulence in 1D Complex Ginzburg-Landau Equation**  
Statistical properties of hole turbulence in complex Ginzburg-Landau equation have been studied. It is found that the probability distribution functions of some characteristic quantities can be identified by Mittag-Leffler function and hyper gamma function.
Frederic Boisson  
Australian National Nuclear Research and Development Organisation NSW AUSTRALIA

Validation of PET-SORTEO Monte Carlo Simulations for the Geometry of the Inveon PET Preclinical Scanner
This work aimed at validating the use of the PETSORTEO Monte Carlo simulation tool to numerically reproduce accurate measurements of the Inveon small animal PET scanner.

Concurrent Session 9G – ACOFT 9 Photonic Sensing 2
Room: CLB 2
Chair: John Arkwright, CSIRO, NSW AUSTRALIA

1530 – 1600
Geoffrey Cranch  
Naval Research Laboratory UNITED STATES OF AMERICA

Advanced Fiber Sensing Techniques for Security and Defense
This manuscript describes a range of miniature photonic sensors that have been developed for underwater applications based on fiber laser strain sensor technology. These include hydrophones, inertial and magnetic field sensors.

1600 – 1615
Scott Foster  
Defence Science and Technology Organisation SA AUSTRALIA

Ultra-low frequency noise DBR fibre laser for sensing strain in the femto-strain regime
We report a single frequency erbium doped distributed Bragg reflector fibre laser, with a cavity length of 10cm. Measured frequency fluctuations are consistent with the fundamental thermodynamic limit above 100Hz with a frequency noise floor of approximately 6Hz/sqrtHz at 1kHz.

1615 – 1630
Gary Allwood  
Edith Cowan University WA AUSTRALIA

Wavelength Division Multiplexing of a Fibre Bragg Grating Sensor Using Transmit-Reflect Detection System
Here we have performed dense wavelength division multiplexing of a single fibre Bragg grating (FBG) sensor interrogated using a transmit-reflect detection system. The FBG was used to sense an applied ultrasonic signal.

1630 – 1645
Eike Zeller  
RMIT University VIC AUSTRALIA

Coupled Waveguide Array Sensing Platform Exploiting Discrete Trapping Behaviour
We report on a novel refractive index sensing concept for aqueous solutions exploiting discrete trapping behavior in coupled waveguide arrays. Modal and beam propagation analysis were performed, allowing sensitivity and detection limit to be estimated.

1645 – 1700
Graham Town  
Macquarie University NSW AUSTRALIA

Broadband Optical Supercontinuum Generation in a Long Cavity Fibre Laser
We describe optical supercontinuum generation in an actively modelocked fibre ring laser using a pulsed modelocking technique. Recirculation of a section of the continuum facilitated spectral broadening.

Concurrent Session 9H – Optics, Photonics and Lasers 14: Ultra-precise Frequency Determination and Distribution
Room: CLB 1
Chair: Brian Orr, Macquarie University NSW AUSTRALIA

1530 – 1545
Sascha Schediwy  
University of Western Australia WA AUSTRALIA

Ultra-Stable Time and Frequency Dissemination Networks for Diverse Applications by Multiple Users
In this paper we discuss the progress of optical fibre time and frequency dissemination from experimental, single-use, point-to-point links, to fully-featured, dissemination networks that simultaneously serve multiple users with diverse applications.
Ken Baldwin  
Australian National University ACT AUSTRALIA  
Long-distance Analog and Digital Dissemination of Reference Radio Frequencies Over Optical Fibers  
Novel analog and digital techniques facilitate dissemination of radio frequency reference signals via optical fiber over long distances (100 km or more). Applications of this National Time and Frequency Network project include Australian radio astronomy.

Wenle Weng  
University of Western Australia WA AUSTRALIA  
Frequency Stabilisation in Whispering-Gallery-Mode Resonators Based on Frequency Doubling Self-Referencing Technique  
By locking a laser and its second-harmonic to two modes in a whispering-gallery-mode resonator, nano-Kelvin temperature sensitivity could be achieved. This can result in improved frequency stabilization with active temperature control.

Sam Francis  
Australian National University ACT AUSTRALIA  
Ultra Weak-Light Phase Detection  
We present an ultra weak-light heterodyne phase measurement technique that uses pre-stabilised lasers to lock to a sub-femtowatt optical signal without cycle slipping in an optical phase lock loop.

David Bowman  
Australian National University ACT AUSTRALIA  
An Internally Sensed Optical Phased Array  
Optical frequency phased-arrays typically rely on an external mechanism to sense aberrations in the outgoing beam. We describe a method that can maintain an arbitrary beam profile without the need for external sensors.

Roland Fleddermann  
Australian National University ACT AUSTRALIA  
Australian Contributions to the GRACE Follow-On Satellite Mission  
The GRACE mission has provided 10 years of Earth gravity field measurements. GRACE Follow-On will ensure continuity of data and improve the precision. We discuss mission technologies with a special focus on Australian contributions.

Thursday 13 December 2012

Brian Schmidt  
Australian National University ACT AUSTRALIA  
Type Ia Supernovae, The Accelerating Cosmos and Dark Energy  
Type Ia supernovae remain one of Astronomy's most precise tools for measuring distances in the Universe. I will describe the cosmological application of these stellar explosions, and chronicle how they were used to discover an accelerating Universe in 1998 – an observation which is most simply explained if more than 70% of the Universe is made up of some previously undetected form of 'Dark Energy'. Over the intervening 13 years, a variety of experiments have been completed, and even more proposed to better constrain the source of the acceleration. I will review the range of experiments, describing the current state of our understanding of the observed acceleration, and speculate about future progress in understanding Dark Energy.
**Discovery of the Higgs Boson**

The Higgs boson explain the origin of mass in the Standard Model of particle physics. July 4 2012, the LHC experiments announced the discovery of a new subatomic Higgs-like particle. I will present the most recent results on this particle.

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**1100 – 1230**

**Concurrent Session 10A – Optics, Photonics and Lasers 10: Plasmonics 2**

*Room: CLB 7*

Chair: Isabelle Staude, Australian National University ACT AUSTRALIA

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**1100 – 1130**

**Ewa Goldys**

Macquarie University NSW AUSTRALIA

**Fluorescent Nanoparticles for Advanced Bioimaging and Biosensing**

Fluorescent nanoparticles form brighter and stable labels for biological applications. We demonstrated background-free imaging of single nanoparticle bioprobes based on nanoscale ruby and plasmonically enhanced lanthanides. A similar plasmonic approach was applied to upconverting nanoparticles.

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**1130 – 1145**

**Alexander Minovich**

Australian National University ACT AUSTRALIA

**Collision of Non-diffracting Airy Surface Plasmons**

We study theoretically and experimentally the interference of two Airy surface plasmons. We investigate the variation of the focal spot for different separation distance between the beams. We demonstrate methods for controlling the focal maximum.

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**1145 – 1200**

**Jon Swaim**

University of Queensland QLD AUSTRALIA

**Plasmonic Whispering Gallery Mode Biosensors**

We demonstrate real-time detection of 10 nm gold nanorods with a SNR of 11.25 and a resonator Q factor of 6 x 105, using the Pound-Drever-Hall frequency stabilization technique.

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**1200 – 1215**

**Ivan Maksymov**

Australian National University ACT AUSTRALIA

**Efficient Control of Polarization-Entangled Photon Pairs with Plasmonic Nanoantennas**

We demonstrate that integration of a plasmonic cross-shaped nanoantenna with a gold mirror allows to overcome the fundamental tradeoff between the spontaneous emission enhancement and extraction efficiency of entangled photons pairs emitted by a single quantum dot.

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**1215 – 1230**

**Ann Roberts**

University of Melbourne VIC AUSTRALIA

**Plasmonic Cross-slot Antennas**

We discuss progress in the development of slot antennas based on resonant apertures in metal films. We show that simultaneous field enhancement and beaming can be produced when an antenna is surrounded by periodic corrugations.

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**1100 – 1230**

**Concurrent Session 10B – Condensed-Matter, Materials and Surface Physics 10: Semiconductors-III**

*Room: CLB 8*

Chair: Ron White, James Cook University, QLD AUSTRALIA

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**1100 – 1130**

**Almantas Pivrikas**

University of Queensland QLD AUSTRALIA

**Transport and Recombination in Disordered Organic Semiconductors**

Charge carrier transport studies in organic solar cells, employing a range of complementary classical and novel techniques, are presented. The relationship between charge carrier transport and bimolecular recombination in high efficiency devices is demonstrated.
Dane McCamey  
University of Sydney NSW AUSTRALIA

A Spin-based Organic Magnetic Field Sensor  
We present a magnetic field sensor, based on electrically detecting spin resonance in organic semiconductors, which operates over two orders of both temperature and magnetic field, including room temperature, and is robust to material degradation.

Barbara Fairchild  
University of Melbourne VIC AUSTRALIA

Annealing Study of Ion Implanted Diamond  
We report on the progressive graphitisation of the damaged region in ion implanted diamond with isochronal annealing. Nanostructured graphite is formed initially from lower density amorphous carbon (a-C) and higher density a-C at higher temperatures.

Adam Micolich  
University of New South Wales NSW AUSTRALIA

Is Thermal Annealing a Viable Alternative for Crystallization in Triethylsilylethynyl Anthradithiophene (TESADT) Organic Transistors?  
Solvent annealing is a well-known method for crystallization of the TESADT semiconductor film in organic transistors. We show that although thermal annealing is also effective in producing crystallization, it compromises the resulting electrical performance.

Robert Robson  
James Cook University QLD AUSTRALIA

Fractional Kinetics in Phase and Configuration Space  
We solve the fractional BGK kinetic equation in phase space, allowing for trapping of charged carriers. Its projection onto configuration space produces a new fractional diffusion equation from which we analyse experimental current profiles.

Fedor Jelezko  
University of Ulm GERMANY

Diamond Based Quantum Technologies  
Quantum information, sensing, magnetic resonance, optical microscopy

Marcus Doherty  
Australian National University ACT AUSTRALIA

A New Optically Addressable Spin Qubit in Diamond  
A report of the discovery of a new optical defect in engineered diamond. The new defect exhibits optical spin-polarisation and readout and is a promising electronic spin qubit or bus for a nuclear spin registry.

Brant Gibson  
University of Melbourne VIC AUSTRALIA

Scalable Patterned Nanodiamond Arrays Containing Single Nitrogen-vacancy Emitters  
We report methodologies for the nanopositioning of nanodiamonds containing single nitrogen-vacancy quantum emitters in an array.

Thomas Keevers  
University of Sydney NSW AUSTRALIA

Slow Hopping of Polaron Pairs in MEH-PPV  
Charge transport in organic materials occurs via stochastic hopping processes. These cause fluctuations in the local Overhauser field, inducing quantum spin-phase decoherence, which we measure to determine the rate of hopping for polaron pairs.
1215 – 1230  **Lloyd Hollenberg**  
*University of Melbourne VIC AUSTRALIA*  
**Diamond NV Spin Qubits for Sensing in Biology**  
Qubits are not just for quantum computingâ€”the latest theoretical and experimental results will be presented showing how the nitrogen-vacancy spin qubit in diamond can be used as a nanoscale magnetometer/sensor in biology with high sensitivity and resolution.

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**1100 – 1230**  
**Concurrent Session 10D – Physics Education 2**  
Room: CLB 5  
Chair: David Hoxley, La Trobe University, VIC AUSTRALIA

**1100 – 1130**  
**Margaret Wegener**  
*University of Queensland QLD AUSTRALIA*  
**The Impact of Values and Self-Identity on University Physics Learning**  
We investigate helping students who may find first-year university physics threatening, because they don’t identify themselves as people who are supposed to succeed, via an intervention that bolsters students’ sense of self.

**1145 – 1200**  
**Sarah Walden**  
*Queensland University of Technology QLD AUSTRALIA*  
**Comparison of Two Physics Honours Seminar Assessment Strategies**  
Assessment data of 53 physics honours seminars at QUT from 2006-2012 is presented. The results show that the intuitive ‘gut feel’ response of academics is often within a few percent of a more detailed assessment.

**1200 – 1215**  
**Judith Pollard**  
*University of Adelaide SA AUSTRALIA*  
**Improving Student Engagement and Outcomes in Level I Physics**  
Extended Physics drop-in centre hours, in-semester tests and direct contact with disengaging students have been used in an attempt to improve student engagement, retention and results. Preliminary analysis indicates some positive outcomes.

**1215 – 1230**  
**Anton Rayner**  
*University of Queensland QLD AUSTRALIA*  
**How a Physics Degree Changes Students’ Attitudes and Learning Behaviours**  
Surveys and interviews show that as student progress through a Physics degree, they more readily discuss ideas with peers, increasingly recognise the importance of communication, and relate Physics to daily life.

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**1100 – 1230**  
**Concurrent Session 10E – Relativity and Gravitation 1**  
Room: CLB 4  
Chair: Susan Scott, Australian National University ACT AUSTRALIA

**1100 – 1130**  
**David McClelland**  
*Australian National University ACT AUSTRALIA*  
**Gravitational Wave Detection Using Laser Interferometry**  
I report on the status of the global effort to detect gravitational waves using long baseline laser interferometry.

**1130 – 1145**  
**Daniel Terno**  
*Macquarie University NSW AUSTRALIA*  
**Photons, Qubits and Satellite Experiments**  
QEYSSAT satellite quantum communication experiments push direct tests of quantum theory up to the scale where the interaction between gravity and quantum phenomena becomes important. We discuss several quantum effects that are relevant for the project.

**1145 – 1200**  
**Philip Threlfall**  
*Australian National University ACT AUSTRALIA*  
**Gravitational Entropy within the Quiescent Cosmology Framework**  
We address the asymptotic behavior of the beginning and end of a large class of conformally related cosmologies. We study these regimes by considering gravitational entropy at very early and late stages of these solutions.
1200 – 1215  **Oleg Sushkov**  
*University of New South Wales NSW AUSTRALIA*  
**Rovibrational Quantum Interferometers and Gravitational Waves**  
We discuss physics of a quantum system in the field of a gravitational wave and estimate the sensitivity of possible quantum experiments.

1215 – 1230  **Graeme Gossel**  
*University of New South Wales NSW AUSTRALIA*  
**Narrow Resonances and Black-Hole-Like Absorption in a Non-Black-Hole Metric**  
We show that a dense spectrum of resonances leading to black hole-like absorption arises in metrics that develop singularities before the black hole condition $R = r_s$ is fulfilled.

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### Concurrent Session 10F – Condensed-Matter, Materials and Surface Physics 13: Instruments and Methods

**Room: CLB 3**  
Chair: Shane Kennedy, Australian Nuclear Science and Technology Organisation NSW AUSTRALIA

#### Time 1100 – 1130  
**Jan Herrman**  
*Department of Innovation, Industry, Science and Research NSW AUSTRALIA*  
**An Ultra-stable Atomic Force Microscope with Integrated Laser Interferometry**  
We report on the development of a metrological scanning probe microscope to implement a primary standard for nanoscale dimensional measurement. It incorporates a quartz tuning fork force detector and a high performance heterodyne laser interferometer system.

#### Time 1130 – 1145  
**Giuseppe Carlo Tettamanzi**  
*University of New South Wales NSW AUSTRALIA*  
**Single-parameter Quantised Charge-pumping via a Few Dopant Atoms**  
Several charge pump geometries have been recently developed for quantum metrology applications; however, none of them has yet achieved high currents and accuracies, together. In this work, a novel approach to the problem is discussed.

#### Time 1145 – 1200  
**Anna Ceguerra**  
*University of Sydney NSW AUSTRALIA*  
**Plane-Based Lattice Rectification of hcp Crystals**  
The plane-based lattice rectification method for atom probe tomography was revisited, in order to apply the method to a non-Bravais crystal system such as hcp magnesium alloys.

#### Time 1200 – 1215  
**Marion Stevens-Kalceff**  
*University of New South Wales NSW AUSTRALIA*  
**Cathodoluminescence Characterisation of Point Defects in GaN Nanomembranes**  
Cathodoluminescence microanalysis (CL) enables high sensitiv, nanoscale spatial resolution detection of impurities and defects in continuous gallium nitride (GaN) membranes of nanometer-scale thickness.

#### Time 1215 – 1230  
**Garry McIntyre**  
*Australian Nuclear Science and Technology Organisation NSW AUSTRALIA*  
**Phonons Observed by Laue Diffraction on a Continuous Neutron Source**  
The projection of the four-dimensional dispersion surfaces of coherent inelastic scattering onto the two dimensions observed by neutron Laue diffraction is dominated by characteristic bow-ties from acoustic phonons to permit rapid determination of sound velocities.

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### Concurrent Session 10G – ACOFT 10 Future Telecomms

**Room: CLB 2**  
Chair: Simon Fleming, University of Sydney, NSW AUSTRALIA

#### Time 1100 – 1130  
**Andrew Ellis**  
*IEEE Distinguished Lecturer University College Cork IRELAND*  
**Current Trends in Optical Communications**  
The performance of optical communication systems becoming firmly limited by the fundamental trade off between signal to noise ratio and optical nonlinearity. This presentation will review these limits, and investigate options to enhance performance.
1130 – 1145  **Manik Attygalle**  
*Defence Science and Technology Organisation SA AUSTRALIA*

**Broadband RF Phase Shifting with a Simple Fibre Interferometer**
A novel photonic technique to produce fixed or time varying phase shifts in radio-frequency signals is experimentally demonstrated. The technique uses an optical interferometric configuration based on a single fibre Bragg grating.

1145 – 1200  **Graham Town**  
*Macquarie University NSW AUSTRALIA*

**Simple Frequency Shift Keyed Radio-Over-Fibre Communication System**
We present numerical and preliminary experimental results demonstrating a novel frequency-shift-keyed radio-over-fibre communication system. The system requires no expensive electro-optic or microwave components, and is capable of operating with terahertz frequency wireless carriers.

1200 – 1215  **Cibby Pulikkaseril**  
*Finisar Australia NSW AUSTRALIA*

**Reconfigurable Remote Nodes in 60 GHz Radio-over-Fiber Networks**
We demonstrate the use of a reconfigurable optical processor to demultiplex and optimize 60 GHz radio-over-fiber channels.

1215 – 1230  **Nicolas Riesen**  
*Australian National University ACT AUSTRALIA*

**Three-Core Weakly-Guiding Mode-Selective Fibre Couplers**
The coupling behaviour of two-core mode-selective couplers (MSC) depends on the spatial-orientation of the asymmetric higher-order modes. This restricts their use for mode de-multiplexing in few-mode fibre networks. The use of three-core MSC’s is presented as a solution.

**Concurrent Session 10H – Optics, Photonics and Lasers 15: Spectroscopy**
*Room: CLB 1*

Chair: Maryanne Large, Canon Information Systems Research Australia, NSW AUSTRALIA

**1100 – 1130**  
**James Anstie**  
*University of Western Australia WA AUSTRALIA*

**High Accuracy Absorption Spectroscopy at the Shot-Noise Limit**
We present results of lineshape analysis of spectra produced by a highly accurate dual-beam spectrometer, including: a ppm level determination of the Boltzmann constant, a newly reported power broadening mechanism and an investigation of transit-time broadening.

**1130 – 1145**  
**Christopher Perrella**  
*University of Western Australia WA AUSTRALIA*

**Applications of Two-Photon Spectroscopy of Rubidium Within Hollow-Core Optical Fibre**
Spectroscopy of a Rubidium two-photon transition conducted within hollow-core fibre is presented. We consider two applications: cross phase modulation between two interacting beams and frequency stabilization are presented.

**1145 – 1200**  
**Tyler Neely**  
*University of Queensland QLD AUSTRALIA*

**Mid-infrared Femtosecond Spectroscopy for Broadband and Rapid Greenhouse Gas Characterization**
We present a comb source and spectrometer for simultaneous broadband measurements in the mid-infrared molecular fingerprint region. Detection of CH is demonstrated, with >3750 resolution elements spanning >80 nm with ~600 MHz resolution.

**1200 – 1215**  
**Brian Orr**  
*Macquarie University NSW AUSTRALIA*

**Trace-level Sensing of Greenhouse Gases by Continuous-wave Cavity-ringdown Spectroscopy**
Rapidly-swept continuous-wave cavity-ringdown spectroscopy enables sensing of trace gases using long-range optical-fiber coupling with a single-ended transmitter-receiver configuration. Sensitive instruments are field-deployable for monitoring of greenhouse gases (e.g., methane emissions from livestock).
Manipulating an Optical Frequency Comb

Using an all optical technique we have divided and multiplied the repetition rate of an optical frequency comb. The comb mode linewidth has also been reduced by locking to a high finesse cavity.

1330 – 1500
Concurrent Session 11A – Optics, Photonics and Lasers 11: Trapping and Beams

Room: CLB 7
Chair: Dragomir Neshev, Australian National University, ACT AUSTRALIA

1330 – 1345
Vladlen Shvedov
Australian National University ACT AUSTRALIA
Levitation of Particles in Air with Optical Vector Beams
We trap spherical particles using a single radially or azimuthally polarized light and demonstrate polarization sensitivity of the photophoretic force. It adds additional flexibility to the optical micromanipulation of the particles in gaseous media.

1345 – 1400
Niko Eckerskorn
Australian National University ACT AUSTRALIA
Particle Dynamics in Photophoretic Optical Traps in Air
We investigate the optically induced thermal forces in photophoretic traps, where micron-sized light absorbing particles are confined in the dark region of a laser beam, using high speed video particle tracking.

1400 – 1415
Alexander Stilgoe
University of Queensland QLD Australia
An Optically Driven Stochastic Motor
Here, Alex presents a stochastic motor driven by optical tweezers. This system displays specific, controllable, non-equilibrium behaviours with the choice of fluid, particle size and refractive index.

1415 – 1430
Rachael Fulcher
University of Sydney NSW AUSTRALIA
Frozen Light Enhancement of Optical Tweezers Near a Stationary Inflection Point
Forces on particles near a waveguide can be enhanced by using frozen light modes in waveguides with stationary inflection points. Such modes have finite coupling at zero group velocity, showing potential for waveguide-based optical tweezers.

1430 – 1445
Wen Jun Toe
University of New South Wales NSW AUSTRALIA
Dark Field Optical Tweezers for Studying Nanoparticle Dynamics
We report a method of characterising physical and optical properties of nanoparticles using optical tweezers combined with dark field microscopy. The technique combines measurements from Brownian motion and spectroscopy to determine nanoparticle size information.

1445 – 1500
Daryl Preece
University of Queensland QLD AUSTRALIA
Measurement of Macrophage Phagocytosis using Optical Tweezers
Macrophages play a key role in the body’s defense system. They dispose of pathogens and regulate homeostasis. We describe a system based around an optical tweezers enabling measurement of the mechanical properties of phagocytosis.

1330 – 1500
Concurrent Session 11B – Condensed-Matter, Materials and Surface Physics 11: Theoretical Condensed-Matter Physics

Room: CLB 8
Chair: Jodie Bradby, Australian National University ACT AUSTRALIA
1330 – 1345
**Andres Alejandro Reynoso**
University of Sydney NSW AUSTRALIA

Floquet Majorana Fermions in Non-magnetic Quantum Wires
For non-magnetic quantum wires in presence of s-wave electron-hole pairing, we show that Majorana fermions appear at the edges of the sample by virtue of a time-dependent rotating spin-orbit coupling driving.

1345 – 1400
**Bogusz Bujnowski**
University of Melbourne VIC AUSTRALIA

The Bose-Hubbard Model for Dipolar Atoms
We study the zero temperature phase diagram of the Bose-Hubbard model including long-range dipolar interactions. We use a mean-field approach to investigate the appearance of non uniform Mott-insulating phases.

1400 – 1415
**Andrew Hayward**
University of Melbourne VIC AUSTRALIA

Fractional Quantum Hall Physics in Jaynes-Cummings-Hubbard Lattices
We propose the Jaynes-Cummings Hubbard (JCH) model as a simulator of fractional quantum hall (FQH) physics. We show how to generate artificial magnetic fields in a JCH lattice, and demonstrate the existence of FQH states.

1415 – 1430
**Bogdan Opanchuk**
Swinburne University of Technology VIC AUSTRALIA

Simulation of Trapped Bose-Einstein Condensates Using the Truncated Wigner Method
A Wigner representation based method to simulate the behavior of multicomponent BEC is presented. The method is based on first principles, takes into account nonlinear losses, and is accurate in the limit of large N.

1430 – 1445
**Elvis Shoko**
Australian National Nuclear Research and Development Organisation NSW AUSTRALIA

Alkali Metal Dynamics in the Beta-Pyrocloroles AOs$_2$O$_6$ (A = K, Rb, Cs) and Their Prospects as Thermoelectric Materials
We are studying oxides of the defect pyrochlore structure as candidates for development into high temperature thermoelectric materials. In this talk I will demonstrate that, indeed, these materials show some promising properties for thermoelectric applications.

1445 – 1500
**Jaan Oitmaa**
University of New South Wales NSW AUSTRALIA

Phase Diagram of Spin S=1 Bilinear-Biquadratic Heisenberg Models
Series expansion methods are used to investigate the phase diagram spin-1 bilinear-biquadratic Heisenberg models on several two-dimensional lattices. A number of recent predictions, particularly near the edge of the Néel phase, are tested.

1330 – 1500
**Concurrent Session 11C – Quantum Information, Concepts and Coherence 11: Cold Atoms**

Room: CLB 6
Chair: Andrew Doherty, University of Sydney, NSW AUSTRALIA

1330 – 1400
**Andrew Truscott**
Australian National University ACT AUSTRALIA

Correlations in Lower Dimensional Quantum Gases
A fundamental property of a three-dimensional Bose-Einstein condensate (BEC) is long range coherence. In lower dimensions, however, this property is not only destroyed, but new states of matter are predicted to exist. Using higher order atom-atom correlations we probe lower dimensional quantum gases and observe the transition to transverse condensation.

1400 – 1415
**Tyler Neely**
University of Queensland QLD AUSTRALIA

Two-Dimensional Vortex Turbulence in a Bose-Einstein Condensate
We experimentally and numerically examine two-dimensional quantum turbulence in a highly oblate BEC, initiated through smallscale forcing. A highly disordered arrangement of vortices is experimentally produced. Numerical examination reveals additional evidence of 2D turbulence.
1415 – 1430  **Karen Kheruntsyan**  
*University of Queensland QLD AUSTRALIA*

**Bell Inequality Test Using Colliding Condensates**
We present the results of a theoretical proposal to demonstrate a Bell inequality violation with massive particles, by realizing a matter-wave analog of the Rarity-Tapster optical setup and applying it to pair-correlated atomproduced in condensate collisions.

1430 – 1445  **Tod Wright**  
*University of Queensland QLD AUSTRALIA*

**Quantum Relaxation of the Tonks-Girardeau Gas**
We investigate the relaxation dynamics of a strongly interacting one-dimensional Bose gas. We discuss the failure of the system to relax to thermal equilibrium, and the nature of its configuration after long evolution times.

1445 – 1500  **Matthew Davis**  
*University of Queensland QLD AUSTRALIA*

**Macroscopic Quantum Self-Trapping in Dynamical Tunnelling with Bose-Einstein Condensates**
We find that increasing interactions causes dynamical tunnelling in Bose-Einstein condensates to shut down above a critical value, however in some parameter regimes tunnelling surprisingly reappears. We develop a minimal model that explains this behaviour.

1330 – 1500

**Concurrent Session 11D – Joint: Quantum Information, Concepts and Condensed-Matter, Materials and Surface Physics**

*Room: CLB 5*

*Chair: Michelle Simmons, University of New South Wales NSW AUSTRALIA*

**Time**

1330 – 1400  **Andrea Morello**  
*University of New South Wales NSW AUSTRALIA*

**Single-Atom Spin Qubits in Silicon**
A phosphorus atom in silicon contains highly-coherent electron- and nuclear-spin quantum bits. Here I describe recent breakthroughs in control and readout of both types of qubit, with a single atom in a silicon nanostructure.

1400 – 1415  **Jarryd Pla**  
*University of New South Wales NSW AUSTRALIA*

**Single Atom Electron and Nuclear Spin Qubits in Silicon**
We demonstrate all-electrical single-shot readout and coherent control of both the electron and nuclear spins of a single phosphorus atom implanted in a silicon nanostructure device.

1415 – 1430  **Andrew Greentree**  
*RMIT University VIC AUSTRALIA*

**Spin Guides, Magnon Collisions and Quantum Magnonics**
We report on the dynamics of magnons in one-dimensional spin chains, with spatially and temporally varying potential. This system has application for quantum information transport and processing, as well as quantum emulation of molecular systems.

1430 – 1445  **Torsten Gaebel**  
*University of Sydney NSW AUSTRALIA*

**Size-reduction of Nanodiamonds Hosting NV Centres via Air Oxidation**
We present the control of the size of nanodiamonds hosting nitrogen-vacancy centres in nanodiamond. We characterize the etch rates for different annealing temperatures in air and follow individual crystals throughout the process.

1445 – 1500  **David Jamieson**  
*University of Melbourne VIC AUSTRALIA*

**Engineering Atomin Silicon: Building Qubits for the Quantum Internet of the Mid-21st C**
New technologies based on the applications of quantum mechanical principles promise revolutionary applications. Described here is a technique based on top-down fabrication principles employing ion implantation offer a fast route to the fabrication of prototype devices.
1330 – 1500  

Concurrent Session 11E – Relativity and Gravitation 2

Room: CLB 4  
Chair: Ben Whale University of Otago NEW ZEALAND

Time  
1330 – 1400  
Ra Inta  
Australian National University ACT AUSTRALIA

Current Status of the Analysis of Data from Ground-based Gravitational Wave Observatories  
Currently the most promising platform for directly detecting gravitational waves are the ground-based laser interferometers. We present the status of ground-based gravitational wave observatories, emphasising the significant contribution made by Australian data analysis groups.

1400 – 1415  
Richard Barry  
Australian National University ACT AUSTRALIA

The Abstract Boundary and Extensions of Space-times  
The Abstract Boundary construction produces a boundary for an n-dimensional manifold by considering multiple embeddings at once. It therefore provides us with an ideal tool with which to consider the properties of space-time extensions.

1415 – 1430  
Michael Tobar  
University of Western Australia WA AUSTRALIA

Testing for Periodic Changes in Fundamental Constants Due to Varying Gravitation Fields and Boosts Using Long-Term Comparison of the SYRTE Atomic Fountains and H-masers  
We analyze data sets from Cs and Rb Fountains compared to various Hydrogen Masers to search for periodic changes correlated with the changing gravitational potential and boost with respect to the Cosmic Microwave Background.

1430 – 1445  
Benjamin Lewis  
Australian National University ACT AUSTRALIA

Looking Beyond Coordinate Singularities  
Visual properties of the skies of different types of black hole are investigated from the perspective of observers on either side of event horizons, to demonstrate software able to utilise a plurality of coordinate charts.

1445 – 1500  
Thanh Nguyen  
Australian National University ACT AUSTRALIA

Off-resonance Thermal Noise of Aluminum Flexure  
We report measured the thermal noise of an Aluminum flexure suspension. The measured noise shows the existence of both structural and viscous damping.

1330 – 1500  

Concurrent Session 11F – Condensed-Matter, Materials and Surface Physics 14

Room: CLB 3  
Chair: Clemens Ulrich, University of New South Wales, NSW AUSTRALIA

Time  
1330 – 1400  
Shane Kennedy  
Australian National Nuclear Research and Development Organisation NSW AUSTRALIA

Opportunities for Materials Research Using Opal, Australia’s New Neutron Source  
The presentation will focus on the capabilities at the Neutron Beam Facility at the OPAL research reactor, including scientific highlights from our research selected to illustrate the potential for applications in condensed matter physics.

1400 – 1415  
Wai Tung Hal Lee  
Australian National Nuclear Research and Development Organisation NSW AUSTRALIA

Polarised Neutrons for Magnetism Research Using Polarised Helium-3 techniques on ANSTO’s Neutron Scattering Instruments  
This presentation will illustrate how polarized neutron scattering can be used for magnetism studies and provide the latest status of the new polarised neutron capabilities at ANSTO instruments using polarised Helium-3 techniques. Instruments
1415 – 1430 Joseph Salfi
University of New South Wales NSW AUSTRALIA
Spatially Resolved Exchange Interaction of Coupled Acceptor Dopants in Silicon
Spin orbit coupling produces acceptor-bound Kramer’s doublets with spin 3/2 and 1/2 in Silicon. Holes occupying tunnel coupled acceptors were studied by scanning tunnelling spectroscopy, elucidating Kramers doublet coupling spectroscopically and in real space.

1430 – 1445 Andrei Rode
Australian National University ACT AUSTRALIA
Structural Modifications of Silicon by Ultrafast Laser Micro-explosion
We present the results of structural characterization of a silicon crystal exposed to a strong shock wave induced by femtosecond-laser micro-explosion in confined geometry into the unexplored area of up to terapascal pressure.

1445 – 1500 Fahd Mohiyaddin
University of New South Wales NSW AUSTRALIA
Spatial Metrology Of Single Atom Spin Qubit Devices
We demonstrate a non-invasive metrology technique to track down the location of an ion implanted donor in a spin qubit experiment, using a combination of classical and quantum-mechanical (atomistic) device simulation platforms.

1330 – 1500
Concurrent Session 11G – ACOFT 11 Lasers 2
Room: CLB 2
Chair: Steve Madden Australian National University ACT AUSTRALIA

Time
1330 – 1345 Tomonori Hu
University of Sydney NSW AUSTRALIA
Single Transverse Mode, 2.9 Micron Q-switched HoPr-doped Fluoride Fiber Laser
We present a Q-switched holmium based fiber laser operating at 2.9 microns reaching peak powers of 96 W, for mid-infrared photonics based applications.

1345 – 1400 Sebastian Ng
University of Adelaide SA AUSTRALIA
Air-clad Holmium-doped Silica Fibre Laser
We report the first air-jacketed holmium fibre laser. The silica fibre laser operates at 2.1 μm with an internal slope efficiency of 69%, and is in-band pumped with a 1.94 μm thulium fibre laser.

1400 – 1415 Khu Vu
Australian National University ACT AUSTRALIA
High Gain Waveguide Amplifier and Laser using Erbium Doped Tellurium Oxide Pumped at 980nm
The 980nm pumped Er doped TeO2 waveguide amplifier produced internal gain of more than 14dB over 5cm long devices and started to laser due to Fresnel reflectivity of the end facets.

1415 – 1430 David Lancaster
University of Adelaide SA AUSTRALIA
A kW class 2 um-wavelength chip laser
We report a directly-written Tm3+:ZBLAN waveguide chip laser with M2 = 1.12 ± 0.08 from a large 45 m diameter waveguide. We demonstrate 1.9 kW Q-switched pulses at 1.9 m and 67% slope efficiency.

1430 – 1445 Darren Hudson
University of Sydney NSW AUSTRALIA
Ultrashort Pulse Fiber Laser Operating in the Mid-Infrared
We demonstrate an ultrashort pulse Holmium-Praseodymium co-doped fiber laser that exhibits passive Q-switching and mode-locking at 2.87 micron via an intra-cavity Semiconductor Saturable Absorber Mirror (SESAM).

1445 – 1500 Neil Broderick
Auckland University NEW ZEALAND
Noise like Pulses in Yb Doped All-Normal Dispersion Fibre Laser with Raman Process
We observe for the first time noise-like-pulses with co-existing Raman pulses in an ANDi laser. We study the strong pulse to pulse fluctuations showing that such laser is not mode-locked despite a regular pulse train.
1330 – 1500

**Concurrent Session 11H – Optics, Photonics and Lasers**

**16: Single Photon Sources**

**Room:** CLB 1  
**Chair:** Alex Clark, University of Sydney NSW AUSTRALIA

<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker</th>
<th>Institution</th>
<th>Title</th>
<th>Summary</th>
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<tbody>
<tr>
<td>1330 – 1345</td>
<td>Stefania Castelletto</td>
<td>Macquarie University NSW AUSTRALIA</td>
<td>Room Temperature Single Photon Emission In Silicon Carbide</td>
<td>Bright room temperature single photon emission from isolated defects in bulk 4H silicon carbide (SiC) is reported. The photo-physical properties of the defect, having emission around 700 nm, is presented.</td>
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<tr>
<td>1345 – 1400</td>
<td>John Canning</td>
<td>University of Sydney NSW AUSTRALIA</td>
<td>Single Photon Sources in Silica Using Nanoparticle Convective Self-assembly Induced Fracturing</td>
<td>Single photon emitting NV-centre containing nanodiamonds are integrated directly into silica using self-assembly and fracturing.</td>
</tr>
<tr>
<td>1400 – 1415</td>
<td>Timothy Karle</td>
<td>University of Melbourne VIC AUSTRALIA</td>
<td>Near-Surface, Spectrally Stable Nitrogen Vacancy Centres</td>
<td>We demonstrate homoepitaxial growth of diamond containing spectrally stable nitrogen vacancy (NV) centres. The linewidth of NV centres in a 100 nm layer are ~140 MHz at T &lt; 12 K, with favourable spin properties.</td>
</tr>
<tr>
<td>1415 – 1430</td>
<td>Carlo Bradac</td>
<td>University of Sydney NSW AUSTRALIA</td>
<td>Effects of the Nanodiamond Host on an NV Centre Emission State</td>
<td>We present the control of the quantum states of nitrogen-vacancy centres in nanodiamond. We investigate the phenomenon of luminescence intermittency (blinking) of the centres as a function of nanodiamond size, surface moieties and interfacing substrate.</td>
</tr>
<tr>
<td>1430 – 1445</td>
<td>Snjezana Tomljenovic-Hanic</td>
<td>University of Melbourne VIC AUSTRALIA</td>
<td>Single-photon Emission from Zinc-oxide Defects</td>
<td>Single-photon sources are important for a range of quantum protocols. We report room temperature single-photon emission and quantum characterization for isolated defects in zinc oxide.</td>
</tr>
<tr>
<td>1445 – 1500</td>
<td>Faraz Inam</td>
<td>Macquarie University NSW AUSTRALIA</td>
<td>NV Centre Emission in an Aerogel Environment</td>
<td>We studied nanodiamond NV centre emission in a substrate free air-like aerogel environment. This novel approach resulted in the identification of the host crystal geometry contributions to emission and estimation of the quantum efficiency.</td>
</tr>
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1530 – 1630

**Concurrent Session 12A – Optics, Photonics and Lasers**

**12: Nanomeasurement**

**Room:** CLB 7  
**Chair:** Manuel Decker, Australian National University, ACT AUSTRALIA

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<thead>
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<th>Time</th>
<th>Speaker</th>
<th>Institution</th>
<th>Title</th>
<th>Summary</th>
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<tbody>
<tr>
<td>1530 – 1545</td>
<td>Nora Tischler</td>
<td>Macquarie University NSW AUSTRALIA</td>
<td>Exploiting the Symmetries of Nanostructures for Metrology Applications</td>
<td>We experimentally and theoretically study the interaction of light with nanostructures by making use of symmetries and conserved quantities. We investigate the potential of this approach using nanoapertures in metal for metrology and related applications.</td>
</tr>
</tbody>
</table>
Andrew Sutton  
Australian National University ACT AUSTRALIA  

**Digitally Enhanced Homodyne Interferometry for Multiplexed, Picometer Sensitive Metrology**

We present a novel optical metrology technique capable of measuring multiple targets with a demonstrated sensitivity of 0.8 pm/Hz. Significant reductions in hardware complexity are achieved through multiplexed, homodyne detection of sensing signals.

Stefan Forstner  
University of Queensland QLD AUSTRALIA  

**Ultrasensitive Cavity Optomechanical Magnetometry**

Optimization of the geometry of cavity optomechanical magnetometers allows a sensitivity surpassing all previous magnetostrictive magnetometers of comparable size. Such ultrasensitive magnetometers may have significant applications in areas such as low field MRI.

Anna Wang  
Harvard University UNITED STATES OF AMERICA  

**High-speed, 3D Tracking of Colloidal Systems Using Digital Holographic Microscopy**

Digital holographic microscopy is used to track colloids at 1000s fps in 3D as they approach an oil-water interface. Their approach as well as their interactions challenge existing literature.

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**1530 – 1630**

**Concurrent Session 12B – Condensed-Matter, Materials and Surface Physics 12: Spin Chains, Spin Ladders and Spin Ice**

**Room: CLB 8**

Chair: Chris Hamer, University of New South Wales NSW AUSTRALIA

**1530 – 1545**

**Bob Aldus**  
Australian National Nuclear Research and Development Organisation NSW AUSTRALIA  

**Ice Rule Coherence in Stuffed Spin Ice**

We present results obtained via polarized neutron scattering on a single crystal of stuffed spin ice down to 0.05 mK and an interpretation of the diffuse neutron scattering patterns obtained.

**1545 – 1600**

**Jaan Oitmaa**  
University of New South Wales NSW AUSTRALIA  

**Thermodynamic Properties of an Anisotropic Heisenberg Model for the XY Pyrochlore Er₂Ti₂O₇**

Series expansion methods are used to calculate thermodynamic properties of an anisotropic spin model for the material Er₂Ti₂O₇, an antiferromagnetic XY pyrochlore system. Results are compared with experimental data, with good agreement.

**1600 – 1615**

**Kirrily Rule**  
Australian National Nuclear Research and Development Organisation NSW AUSTRALIA  

**The Complex Magnetic Phase Diagram of the Quantum Spin Chain Material, Linarite, PbCuSO₄(OH)₂**

Linarite, PbCuSO₄(OH)₂, is a 1D, Cu-O spin chain material with competing J₁-J₂ interactions. The magnetic structure and complex phase diagram will be presented from neutron scattering and bulk properties measurements.

**1615 – 1630**

**Aroon O’Brien**  
University of Sydney NSW AUSTRALIA  

**Coulombic Charge Ice**

We consider a classical model of charges on a pyrochlore lattice in the presence of long-range Coulomb interactions. We show that the model supports a Coulomb phase and discuss analogies with the dipolar spin ice model.

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**1530 – 1630**

**Concurrent Session 12C – Quantum Information, Concepts and Coherence 13: Cold Atto2**

**Room: CLB 6**

Chair: Matthew Davis, University of Queensland QLD AUSTRALIA
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<tr>
<th>Time</th>
<th>Session/Author/Title</th>
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<tbody>
<tr>
<td>1530 – 1545</td>
<td>Mikhail Egorov, Monash University VIC AUSTRALIA, Precision Measurement of S-wave Scattering Lengths</td>
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<td>We have developed a 1D treatment of collective oscillations of a two-component BEC and used them for the precision measurement of a scattering length in 87Rb with a relative uncertainty of 1.6 ± 10^-4.</td>
</tr>
<tr>
<td>1545 – 1600</td>
<td>Peter Drummond, Swinburne University of Technology VIC AUSTRALIA, Entanglement and Optimised Interferometric Phase Measurement in BECs</td>
</tr>
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<td>We derive novel phase-entanglement and spin-squeezing criteria that are immune to number fluctuations. These are utilized to obtain an operational definition of relative phase-measurement sensitivity, via analysis of quantum entanglement in atom interferometry.</td>
</tr>
<tr>
<td>1600 – 1615</td>
<td>Jan Zill, University of Queensland QLD AUSTRALIA, Exact Quench Dynamics of the One-Dimensional Bose Gas Using the Lieb-Liniger Model</td>
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<td>Using the Bethe ansatz, we investigate the exact relaxation dynamics of the one-dimensional Bose gas following a sudden change of the interparticle interaction strength, and compare the final state to the predictions of statistical mechanics.</td>
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<tr>
<td>1615 – 1630</td>
<td>Mark Baker, University of Queensland QLD AUSTRALIA, Toroidal Optical Trap Potentials with a 87Rb BEC</td>
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<td>We present details of our initial experiments with a Rb BEC in toroidal traps generated using time-averaged optical potentials. Our preliminary results of our loading technique and extension to atom interferometry will be detailed.</td>
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**1530 – 1630**

**Concurrent Session 12D – Quantum Information, Concepts and Coherence 12: Trapped Ions**

Room: CLB 5

Chair: David Reilly, University of Sydney, NSW AUSTRALIA

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<th>Time</th>
<th>Session/Author/Title</th>
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<tbody>
<tr>
<td>1530 – 1600</td>
<td>Michael Biercuk, University of Sydney NSW AUSTRALIA, From Quantum Control to Quantum Simulation with Trapped Ions</td>
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<td>We provide an overview of recent experimental results using ion crystals in a Penning trap for quantum control, quantum metrology, and quantum simulation.</td>
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<tr>
<td>1600 – 1615</td>
<td>Benjamin Norton, Griffith University QLD AUSTRALIA, Observation of a Large Optical Phase Shift from a Single Atom</td>
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<td>Here we show a large phase shift on an illumination field by a single atom. We achieve a maximum phase shift of 1.3±0.1 rad measured by changing the illumination field detuning from red to blue.</td>
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<tr>
<td>1615 – 1630</td>
<td>Erik Streed, Griffith University QLD AUSTRALIA, The Shadow of a Single Atom</td>
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<td>We have shown the first absorption imaging of a single atom. Contrast of 3.1(3)% was observed in the absorption of 370 nm light by a single 174Yb+, imaged with a 0.64 NA phase Fresnel lens.</td>
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**1530 – 1630**

**Concurrent Session 12E – Relativity and Gravitation 3**

Room: CLB 4

Chair: John Steele, University of New South Wales NSW AUSTRALIA
1530 – 1545
Edward Teo
Australian National University ACT AUSTRALIA

Balanced Electric-Magnetic Dihole in Kaluza-Klein Theory
We present a dihole solution in Kaluza-Klein theory, describing a superposition of an electric and a magnetic black hole. The balanced system has a space-time that is completely regular on and outside the event horizons.

1545 – 1600
Ben Whale
University of Otago NEW ZEALAND

The Standard Chart Based Approach to Studying the Global Structure of a Spacetime Induces a Coordinate Invariant Boundary of Ideal Points
Results and examples are presented which demonstrate that the boundary is a coordinate invariant foundation for the intuitive analysis of global structure. Moreover, it generalises Penrose’s conformal boundary and carries a differential structure.

1600 – 1615
Mr Tommaso Demarie
Macquarie University NSW AUSTRALIA

Gauge Invariant Qubits in Curved Space-time
Gravity causes light polarization to rotate. We demonstrate that while the amount of rotation depends on the choice of the reference frame, a gauge-independent geometric phase exists for closed paths in general space-times.

1615 – 1630
Bram Slagmolen
Australian National University ACT AUSTRALIA

Australia and the Advanced LIGO Gravitational Wave Detector
We shall describe results of initial commissioning of the interferometer at the Advanced LIGO Hanford Observatory.

1530 – 1630
Room: CLB 3
Chair: Matthew Hole, Australian National University ACT AUSTRALIA

1530 – 1545
Andrew Ringsmuth
University of Queensland QLD AUSTRALIA

Multiscale Structure and Energetics in Photosynthetic Solar Energy Harvesting
We predict long-range quantum coherence between excitation energy transfer states in biomimetic light harvesting networks, at ambient temperature. We extend the model to light harvesting energetics more broadly, towards whole-system optimization for efficient energy harvesting.

1545 – 1600
Yinan Zhang
Swinburne University VIC AUSTRALIA

Broadband Absorption Enhancement in Ultra-thin Crystalline Si Solar Cells by a Sandwich Photonic-Plasmonic Structure
We demonstrate a more than 45% enhancement in broadband light absorption in 2 Åm Si solar cells with periodic Si photonic nanostructure on the front surface and plamonic metal nanoparticles on the rear surface.

1600 – 1615
Craig Buckley
Curtin University WA AUSTRALIA

Coupling Metal Hydrides with Concentrated Solar Thermal Applications for Electricity Generation in Remote Areas
Concentrated solar thermal can be used to efficiently generate electricity in remote locations both day and night. The solar energy is converted to heat energy and then chemical energy is stored in a metal-hydrogen compound.

1615 – 1630
Narges Mohammadi
Swinburne University of Technology VIC AUSTRALIA

Bathchromic Shift in Photoabsorption Spectra of Organic Dye Sensitisers Through Structural Modifications for Better Solar Cells
A new strategy is proposed to design organic dye sensitizers with desirable photo-absorption properties for better solar cells. Rational chemical substitutions and their effects on band-gap and absorption spectra of the dyes are investigated computationally.
Concurrent Session 12G – ACOFT 12 Chalcogenide Waveguides

Room: CLB 2
Chair: Tanya Monro, University of Adelaide, SA AUSTRALIA

1530 – 1630

1530 – 1545
Irina V. Kabakova
University of Sydney NSW AUSTRALIA

Intensity-Dependent Photosensitivity of Chalcogenide As$_2$S$_3$ Fibers
We investigate the photoinduced refractive index changes in As$_2$S$_3$ chalcogenide fibers and show that the index evolution is an intensity-dependent two-stage process. These novel findings can have application in design and fabrication of photoinduced devices.

1545 – 1600
Irina V. Kabakova
University of Sydney NSW AUSTRALIA

Stimulated Brillouin Scattering and Bragg Grating Formation in As$_2$Se$_3$ Fiber
We demonstrate formation of internal gratings in step-index As$_2$Se$_3$ chalcogenide fibers via two-photon absorption of a 1550 nm light. Together with the grating growth, a strong SBS signal is generated resulting in grating-SBS interplay.

1600 – 1615
Khu Vu
Australian National University ACT AUSTRALIA

Hybrid As$_2$S$_3$ on Er Doped TeO$_2$ Waveguide for Lossless Nonlinear Optics
We have fabricated single mode anomalous dispersion As$_2$S$_3$ on Er doped TeO$_2$ waveguide with near zero propagation loss. Lossless waveguide with high nonlinear coefficient can be achieved with higher 1480nm pump power.

1615 – 1630
Matthew Collins
University of Sydney NSW AUSTRALIA

Impact of Raman Noise and Dispersion on Photon-Pair generation in chalcogenide (As$_2$S$_3$)
We directly measured the spontaneous Raman spectrum in As$_2$S$_3$ and successfully mitigated Raman-noise using dispersion engineering, enhancing the coincidence-to-accidental ratio (CAR) to 16.8. We measured g(2)(0)=0.23 in the quantum regime, confirming heralded single photon operation.

Concurrent Session 12H – Optics, Photonics and Lasers

Room: CLB 1
Chair: Stefania Castelletto, Macquarie University, NSW AUSTRALIA

1530 – 1630

1530 – 1545
Gediminas Gervinskas
Swinburne University of Technology VIC AUSTRALIA

Light Extraction and Fluorescence in UV Micro-fluidic Applications
Patterns for light extraction from light emitting diodes (LEDs) in the limiting UV spectral range of 240-300 nm are fabricated by focused ion beam lithography. A micro-fluidic chip for time-resolved fluorescence imaging under UV-LED excitation is demonstrated.

1545 – 1600
Jelle Storteboom
Swinburne University of Technology VIC AUSTRALIA

Characterisation of Nanodiamond-dispersed Photopolymers Towards High-density Optical Data Storage
We report on the experimental investigation of the photochromic effect of nitrogen vacancy centres in nanodiamonds dispersed in photopolymers, as well as their applications in high-density optical data storage.

1600 – 1615
Matthew Petrasiunas
Griffith University QLD AUSTRALIA

Three-photon Absorption in Quantum Dots Using Ultrafast Fibre Lasers
We present measurements of three-photon absorption and emission in CdSe and InP quantum dots, with applications to biological imaging. We excite quantum dots with pulses from ultrafast fibre lasers at 1.5-2.0 um in wavelength.
Monday 10 December 2012
1700 – 1830
Poster Session 1
Room: Tyree Room / Leighton Hall in the John Niland Scientia Building

Poster Presentations

1. **Noel Hanna**  
   University of New South Wales NSW AUSTRALIA  
   Resonances and Bandwidths in the Vocal Tract and Why They Are Important for Speech Comprehension  
   The bandwidths of vocal tract resonances are critical: too narrow allows speech harmonics to resonances, too broad gives insufficient boost to identify phonemes. We report the first measurements of bandwidths and low frequency behaviour.

2. **Samuel Blake**  
   University of Sydney NSW AUSTRALIA  
   Towards a Next-Generation Electronic Portal Device for Dual-Mode Imaging and Dosimetry  
   The x-ray and optical response of an electronic portal imaging device was modeled using Monte Carlo simulations. Optical absorption in the photodiode produced broader profiles than those obtained for x-ray energy deposition in the phosphor.

3. **Frederic Boisson**  
   Australian National Nuclear Research and Development Organisation NSW AUSTRALIA  
   Imaging Performance Of The Inveon SPECT System Comparing Rat And Mouse Dedicated Single And Multi-Pinhole Collimators  
   This study focused on comparing the performance obtained with the Inveon SPECT using different collimators. The NU-4 Image Quality phantom was used to derive quantitative metrics for different acquisition and reconstruction settings.

4. **Michael Lerch**  
   University of Wollongong NSW AUSTRALIA  
   Enhancing The Sensitivity Of In Vitro 9L Cells Exposed To X-ray Radiation Fields Using Tantalum Pentoxide Nanoparticles  
   Irradiation of 9L cells with tantalum pentoxide nanoparticles and 10 MV, 6 MV and 150 kV revealed a sensitisation enhancement ratio (SER) of 1.21, 1.07 and 1.05 respectively.

5. **Michael Lerch**  
   University of Wollongong NSW AUSTRALIA  
   Characterization of the Valley Dose between Synchrotron Generated X-Ray Microbeams  
   We present the first direct measurement and systematic analysis of satellites in an MRT context. Such satellites will need to be included in future radiation transport models to be developed for MRT dose planning systems.

6. **Aimee McNamara**  
   University of Sydney NSW AUSTRALIA  
   Positron Emission Tomography Coincidence Detection with Photon Polarisation  
   Positron annihilation photons are emitted in a pure quantum state and when detected in coincidence, the photon pairs possess orthogonal polarisation. This polarisation correlation can be exploited to improve image quality in positron emission tomography.

7. **Aimee McNamara**  
   University of Sydney NSW AUSTRALIA  
   Evaluating the Imaging Performance of Electronic Portal Imaging Devices  
   The imaging performance of an electronic portal imaging device was evaluated with Monte Carlo simulations, which self-consistently modelled both x-ray and optical photon interactions. The optical contribution to signal noise was found to be non-negligible.
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<tr>
<td>8</td>
<td>Michael Lerch</td>
<td>University of Wollongong NSW</td>
<td>Enhanced Radiosensitization of Resistant Tumour Cells to Radiotherapy: A Novel Approach on Biomodulation in DNA by Chemotherapy Drug</td>
<td>A significant enhancement in targeted tumour treatment due to Auger electrons can be achieved by combining the effects of the anticancer drugs methotrexate (MTX) and the halogenated thymidine analog bromodeoxyuridine (BrUdR) with X-ray radiation beams.</td>
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<td>9</td>
<td>Kathy Willowson</td>
<td>University of Sydney NSW</td>
<td>Quantitative Positron Emission Tomography of 90Y</td>
<td>Quantitative dosimetry using 90Y PET/CT images and dose kernel convolution has been validated and applied to patient data following radioembolisation to treat liver cancer. The possibility of 90Y 3D polymer dosimetry has also been demonstrated.</td>
</tr>
<tr>
<td>10</td>
<td>Chiara Paviolo</td>
<td>Swinburne University of Technology VIC</td>
<td>Plasmonic properties of gold nanoparticles can induce intracellular calcium transients</td>
<td>It is shown that laser excitation of Au nanoparticles taken up by NG108-15 neuronal cells can induce an intracellular Ca2+ release without altering other normal cell functions. This may serve to enhance the process of infrared nerve stimulation.</td>
</tr>
<tr>
<td>11</td>
<td>Monique Tourell</td>
<td>Queensland University of Technology QLD</td>
<td>A Study of Water Diffusion in Partially Aligned Fibre Networks.</td>
<td>Langevin dynamics computer simulations were used to study the quantitative relationship between the organisation of fibre networks and the diffusion tensor of water in model anisotropic tissue.</td>
</tr>
<tr>
<td>12</td>
<td>Feng Wang</td>
<td>Swinburne University of Technology VIC</td>
<td>Dynamics of Cu2+-phenylalanine complexes under micro-hydrated environment simulated using CPMD</td>
<td>Dynamics of Cu2+ and phenylalanine (Phe) under micro-hydration process has been studied using quantum mechanical (QM) and Car-Parrinello molecular dynamics (CPMD) simulation. It unveils that stable complexes of Cu2+Phe.nH2O(n&lt;=4) has a unique hydrogen bond network.</td>
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<tr>
<td>13</td>
<td>Wayne Hutchison</td>
<td>University of New South Wales ACT</td>
<td>Magnetic Structure of TbNiAl4 in Applied Field</td>
<td>Single crystal neutron diffraction in applied magnetic fields up to 11.5 T are used to follow the evolution of the TbNiAl4 magnetic structures. These results, together with magnetometry, can explain the inverse magnetocaloric effect.</td>
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<tr>
<td>14</td>
<td>Shane Kennedy</td>
<td>Australian Nuclear Science and Technology Organisation NSW</td>
<td>Magnetic Properties and Magnetocaloric Effect of NdMn2-xTixSi2 Compounds</td>
<td>Magnetocaloric effect around TC is found to decrease with Ti content in NdMn2-xTixSi2 from 28 J kg⁻¹ K⁻¹ for x=0 to 10 J kg⁻¹ K⁻¹ for x=0.3. Neutron investigations indicate that magnetostructural coupling plays a critical role on the Magnetocaloric effect.</td>
</tr>
<tr>
<td>15</td>
<td>Tim Bastow</td>
<td>CSIRO VIC</td>
<td>NMR Detection of Defect Phases in Solids</td>
<td>NMR is shown to provide valuable insights into the defect structures occurring in a number of solid inorganic and metallic systems.</td>
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<tr>
<td>16</td>
<td>Richard Mole</td>
<td>Australian National Nuclear Research and Development Organisation NSW</td>
<td>A neutron spectroscopy investigation of highly anisotropic Co(II) spin centres</td>
<td>The results of a neutron scattering investigation of a series of cobalt dimer molecular magnets are presented. Inelastic scattering is used to elucidate the coupling between Co ions in zero field.</td>
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<td>17</td>
<td>Anton Stampfl</td>
<td>Australian Nuclear Science and Technology Organisation NSW</td>
<td>The Magnetic Behaviour of CrO2 up to 40 GPa</td>
<td>The abstract describes the magnetic behaviour of CrO2 under pressure.</td>
</tr>
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</table>
18  Glen Stewart  
University of New South Wales NSW AUSTRALIA  
The Magnetic Hyperfine Field at the 169Tm-site in TmFe11Ti  
In this presentation, low temperature 169Tm-Mossbauer spectra recorded for tetragonal TmFe11Ti reveal that the Tm3+ ion’s 4f-shell is “fully-stretched” with |<Jz>| = J, in accordance with proposed crystal field and exchange interaction parameters.

19  Glen Stewart  
University of New South Wales NSW AUSTRALIA  
Magnetic Order in ErGa and TmGa  
Neutron diffraction and Moessbauer spectroscopy are employed to monitor the temperature dependence of the magnetic structures for ErGa and TmGa and to investigate the role of the rare earth site crystal field interaction.

20  Shane Kennedy  
Australian Nuclear Science and Technology Organisation NSW AUSTRALIA  
Magnetostructural Coupling and Giant Magnetoocaloric Effect in NdMn2Si2  
A giant magnetocaloric effect (28 J kg⁻¹ K⁻¹ with B = 0.5T) is obtained around TC = 32 K in NdMn2Si2. Detailed Neutron investigations indicate that this effect can be ascribed to the magnetostructural coupling.

21  Daniel Drumm  
University of Melbourne VIC AUSTRALIA  
The Xe center in diamond by Raman spectroscopy  
Raman spectroscopy of Xe centres in diamond using the novel probe-enhanced technique shows evidence in support of theoretical predictions of the geometry of the Xe defect centre in diamond.

22  Ranojit Kumar Dutta  
City University DHAKA BANGLADESH  
Optical and Structural Properties of Lead Doped Cadmium Sulfide Thin Film Deposited by Spray Pyrolysis Technique  
Lead doped cadmium sulfide thin film were deposited onto glass substrate at temperature 523K by a low cost spray pyrolysis technique. The film were characterized their structural and optical properties by energy dispersive x-ray, scanning electron microscopy, x-ray diffraction, UV-VIS spectrophotometer respectively.

23  Sajad Ghatreh-Samani  
Macquarie University NSW AUSTRALIA  
Transmittance and effective refractive index of polymer nanocomposites  
This paper presents calculations of the extinction coefficient of three different polymer nanocomposites highlighting the useful range of parameters (nanoparticle radius, wavelength, and volume fraction) for controlling the effective index in transmissive optical devices.

24  Alice Mahoney  
Quantum Nanoscience Lab NSW AUSTRALIA  
Dispersive Charge Detection with Radio Frequency Gate Sensors  
We outline a new charge sensing technique aimed at reading out large arrays of qubits. By detecting small changes in (quantum) capacitance, our method uses gate electrodes that define a quantum dot as charge sensors.

25  Dale Prokopovich  
Australian National Nuclear Research and Development Organisation NSW AUSTRALIA  
Investigation of Spatially Localised Radiation Induced Polarisation in CdTe  
We have investigated the localized electric field polarisation effect in CdTe detector material. The polarisation effect produces a localised degradation in the electric field strength resulting in a reduction of detector performance.

26  Ilya Shadrivov  
Australian National University ACT AUSTRALIA  
Giant pure nonlinear optical activity  
We propose a metamaterial with giant nonlinear optical activity, but vanishing linear activity. Such properties are not found in natural materials, and we refer to this regime as pure nonlinear optical activity.

27  Robert Elliman  
Australian National University ACT AUSTRALIA  
Resistive Switching in High-k Dielectrics for Non-volatile Memory Applications  
We review our recent research on resistive switching in transition metal oxides for use as nonvolatile resistive random access memory (ReRAM), including the effect of film microstructure on switching characteristics and new data on metal-bridge memory.
28 Jodie Bradby  
Australian National University ACT AUSTRALIA  
Deformation of Amorphous Germanium by Nanoindentation  
The mechanical deformation mechanisms of pure-ion-implanted amorphous germanium are investigated using nanoindentation. In contrast to crystalline germanium, a series of high-pressure phase transformations are observed to occur.

29 Adam Burke  
University of New South Wales NSW AUSTRALIA  
The Origin of Gate Hysteresis in p-type Si-doped AlGaAs/GaAs Heterostructures  
We studied the gate hysteresis in the modulation-doped AlGaAs/GaAs heterostructures used for low-dimensional hole devices. We show the hysteresis arises from a combination of GaAs surface-state trapping and charge migration in the doping layer.

30 Stefania Castelletto  
Macquarie University NSW AUSTRALIA  
Hybrid Sapphire-Diamond Spin measurements  
We propose a non-optical sensing technology based on precision microwave and millimetre-wave technology. Quantum measurements of the spin resonances of various engineered doped diamond samples will be performed as low as 25 mK.

31 Juan Pablo Dehollain  
University of New South Wales NSW AUSTRALIA  
Nanoscale Broadband Transmission Lines for Spin Qubit Control  
This work presents guidelines for the design and simulation of nanoscale transmission lines, aimed at generating oscillating magnetic fields to control single spin qubits through magnetic resonance.

32 Daniel Drumm  
University of Melbourne VIC AUSTRALIA  
Ab initio calculation of atomically confined Si:P bilayers  
Silicon technology is moving towards the third dimension. We perform the first ab initio calculations of atomically confined dual donor structures in silicon. Bandstructures, valley splittings, and the extent of the electronic density are presented.

33 Daniel Drumm  
University of Melbourne VIC AUSTRALIA  
Vibrational spectra of NV- defects in diamond by ab initio calculation  
Assumptions in the literature regarding methodological choices for examining vibrational spectra of NV defects in diamond are tested. The results challenge previously held views on the efficacy of functionals and the sufficiency of supercell size.

34 Rachpon Kalra  
University of New South Wales NSW AUSTRALIA  
Towards Two-Qubit Gate Operations on Coupled Spin Qubits in Silicon  
We report on progress towards demonstrating phosphorous donor-based two-qubit operations in silicon.

35 Desmond Lau  
University of Melbourne VIC AUSTRALIA  
High Yield Fabrication of Near Infrared Single Photon Sources in Diamond  
We present recent progress made in fabricating high yield, high quality single photon emitters in the infrared range in single crystal diamond.

36 Kiran Mangalampalli  
Australian National University CANBERRA ACT AUSTRALIA  
Controlled Temperature Indentation on Si to Investigate the Phase Transformations  
Nanoindentation has been performed with a sharp indenter on silicon structures in order to understand the plastic deformation mechanisms. The deformed structures were characterized using Transmission Electron Microscopy and Raman spectroscopy.

37 Richard Mildren  
Macquarie University NSW AUSTRALIA  
Polarisation dependent nanostructuring of diamond surface by two-photon ultraviolet etching  
We report wavelength-scale corrugations in the ultraviolet-laser etched surface of single crystal diamond which are produced depending on the incident polarization. The results are important for understanding the mechanism for atom ejection.

38 Sherman Wong  
Australian National University ACT AUSTRALIA  
Silicon High-Pressure Phases under High Load Nanoindentation  
The effects of tip diameter and maximum load on the volume of high pressure phases of silicon created through nanoindentation were explored, especially in the previously unexplored large tip diameter/high load range.
Relativity Concept Inventory

Concept inventories are useful instruments to probe student understanding in science topics, but little has been done to develop one for special relativity. The authors aim to develop and validate one, the Relativity Concept Inventory.

Addressing student misconceptions of phasors and AC resonance

Interactive Lecture Demonstrations, using a ‘Predict, Observe, Discuss, Synthesise’ learning cycle and audience response devices (i.e. clickers), have been used to improve students’ conceptual understanding of phasors and AC resonance in an introductory electronics course.

Indicators of Senior Physics Enrolment

A logistic regression analysis used to identify indicators that impact on a student selecting senior physics, revealed that 68% confidence level in describing physics concepts is the most important.

The UQ Physics Museum – New Learning Opportunities from Old Equipment?

The UQ Physics Museum has been refurbished. I will discuss ways we have used the collection to help students learn about instrument design in the past, and our expanded plans for the future.

Educational Games For Undergraduate Physics

We present our case for why games provide another tool in the repertoire for education. We state the WUPI Principle: Teaching, Learning, Assessment and Fun ‘While you Play It’

‘Just in Time’ for the Lecture

Is the traditional university lecture worthwhile, especially in the modern information-rich world? We have trialled a ‘just in time’ teaching approach to nudge staff and student use of the lecture towards a more effective experience.

Try Before You Buy-Trialling Teaching Methods to Inform Topic Redesign

To prepare for the redesign of a first year physics topic in 2013, we have trialed team-based learning and inquiry-based practicals. This paper presents the evaluation of these trials and our design progress so far.

An Introduction to Climate Change

A lecture presentation has been developed that introduces physics students to the science of climate change and its impact in society. Student feedback indicates a high level of satisfaction with the presentation.

On gravitational sedimentation of an agglomerate consisting of two identical spherical particles

Mathematical modeling and analysis of a gravitational sedimentation process of an agglomerate consisting of two spherical particles has been carried out. It has been shown, that simultaneously to a vertical sedimentation can occur and appreciable transversal drift of the agglomerate. A velocity of the agglomerate’s sedimentation proves to be much greater than the sedimentation velocity of spherical particles forming it.
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<td>49</td>
<td>Jim Williams</td>
<td>University of Western Australia WA AUSTRALIA</td>
<td><em>A History of Measurement at UWA from Idea to Workshop to Discovery</em></td>
<td>Some modern historical developments of atomic and surface Physics achievements at UWA are indicated from birth to success, with pictures following the concepts of great idea, design, construction, testing, results, analysis and publications.</td>
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<td>50</td>
<td>Luca Chiari</td>
<td>Flinders University SA AUSTRALIA</td>
<td>Lower Bounds To Future Sea Level Rise</td>
<td>Lower bounds to 2000-2200 global-mean sea level rise are projected by coupling a semi-empirical method to a simple climate model that is run under a range of fossil fuel exhaustion scenarios.</td>
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<td>51</td>
<td>Murray Hamilton</td>
<td>University of Adelaide SA AUSTRALIA</td>
<td>Polarsonde: Profiling Supercooled Liquid Water in Clouds.</td>
<td>Polarsonde is a low-cost instrument for profiling supercooled liquid in clouds. Progress toward validation of the instrument will be presented.</td>
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<td>52</td>
<td>Andres Albornoz</td>
<td>University of Sydney NSW AUSTRALIA</td>
<td>A study of exclusive charmed semileptonic decays of B mesons at Belle with a fully reconstructed hadronic tag method</td>
<td>We present a study of charmed semileptonic B meson decays with the aim of extracting the shape of the hadronic form factor in order to decrease the uncertainty in the determination of the CKM matrix element $</td>
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<td>53</td>
<td>Badriah Alshahrani</td>
<td>Australian National University ACT AUSTRALIA</td>
<td>Measurement of the radiative branching ratio for the Hoyle state using cascade gamma decays</td>
<td>A new setup, consisting of four 5&quot; by 5&quot; NaI scintillators and an array of particle detectors, is being developed to improve the $\text{Tal/T}$ ratio for the Hoyle state in $^{12}\text{C}$.</td>
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<td>54</td>
<td>Sundance Bilson-Thompson</td>
<td>University of Adelaide SA AUSTRALIA</td>
<td>Preons as Topological Features of Quantum Gravity</td>
<td>We discuss the possibility that in theories of quantum gravity with discrete spacetime, the Standard Model fermions and bosons may arise as composites of defects in spacetime, with interactions governed by topological constraints.</td>
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<td>55</td>
<td>Igor Gontchar</td>
<td>Omsk State Transport University RUSSIA</td>
<td>Nuclear Fission as Thermal Decay of the Metastable State: How Accurate is Our Description of this Process?</td>
<td>Accuracy of analytical Kramers formulas for fission rate of excited nuclei is studied. This is done solving numerically the Smoluchowski equation. Results are relevant for general problem of thermal decay of metastable state.</td>
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<td>56</td>
<td>Geng-Yuan Jeng</td>
<td>University of Sydney NSW AUSTRALIA</td>
<td>Search for the Standard Model Higgs in the H±±t Channel with the ATLAS Detector at the LHC</td>
<td>A search for the Standard Model (SM) Higgs boson decaying into a pair of $t$ leptons performed with the ATLAS detector at the LHC is presented.</td>
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<td>57</td>
<td>Thomas Cunningham</td>
<td>University of Sydney NSW AUSTRALIA</td>
<td>A Search for Purely Leptonic B Meson Decays at Belle</td>
<td>We present a search for the purely leptonic $B$ decays $B^{\pm} \rightarrow e^{\pm} \tau_{\pm}^{\pm}$ and $B^{\pm} \rightarrow \ell^{\pm} \ell_{\pm}^{\pm}$ using the full data set of $711 \text{ fb}^{-1}$ collected at the $\Upsilon(4S)$ resonance by the Belle detector at the KEKB asymmetric collider.</td>
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<td>58</td>
<td>Mushtaq Loan</td>
<td>Jinan University ACT AUSTRALIA</td>
<td>Analysis of Static Hexaquark Potential in Lattice QCD</td>
<td>We study the static hexaquark potential of in lattice QCD. Our preliminary results suggest that, for the separation between diquarks larger than internal diquark distance, the hexaquark system behaves as a multiquark bound state.</td>
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<td>59</td>
<td>Mapril Ng</td>
<td>Australian National University ACT AUSTRALIA</td>
<td>Development of a new Si(Li) Array for the Pair Spectroscopy of the Hoyle state</td>
<td>A new magnetic pair spectrometer combined with high resolution Si(Li) detector array is being developed for the measurement of high energy transition in low mass nuclei. One of the first applications of the spectrometer will be the electromagnetic decay properties of the Hoyle state in 12C.</td>
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<td>60</td>
<td>Francesco Nuti</td>
<td>University of Melbourne VIC AUSTRALIA</td>
<td>WW/WZ production in the semileptonic channel in ATLAS</td>
<td>Results on WW and WZ production in the semileptonic channel in 7 TeV proton-proton scattering are presented, based on data taken by the ATLAS experiment in 2011.</td>
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<td>61</td>
<td>Puvanesvari Rajan</td>
<td>Australian National UniversityACT AUSTRALIA</td>
<td>Particle-plus-Core Models of Nuclear Models</td>
<td>Selected problems particle-plus-core models of nuclear structure are considered, including the implications of core-vibrations for nuclear structure as one to three nucleons are added to a closed shell.</td>
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<td>62</td>
<td>Nathan Hall</td>
<td>University of Adelaide SA AUSTRALIA</td>
<td>Interference Radiative Corrections to the Proton’s Weak Charge</td>
<td>By making the most precise determination of the proton’s weak charge to date, QWEAK will search for evidence of new physics. We examine those corrections important to the accurate interpretation of the QWEAK experiment</td>
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<td>63</td>
<td>Shaun Smith</td>
<td>Queensland University of Technology QLD AUSTRALIA</td>
<td>Development of a Time Coincident Detection System for Detection of Cosmic-Ray Muons</td>
<td>This work presents a time coincident detection system used to quantify muon counts.</td>
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<td>64</td>
<td>Michaela Srncik</td>
<td>Australian National University AUSTRALIA</td>
<td>Is it Possible to Detect 236U and Pu in European Roe Deer Antlers?</td>
<td>The potential to use antlers for the analysis of the 236U and plutonium uptake in the environment was investigated. The respective measurements were carried out by Accelerator Mass Spectrometry (AMS).</td>
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<td>65</td>
<td>Rizki Syarif</td>
<td>University of Sydney NSW AUSTRALIA</td>
<td>J/psi pair analysis as a probe of double parton scattering using ATLAS data</td>
<td>We present a study of J/psi pairs produced from proton-proton collisions at centre-of-mass energy of 7 TeV at ATLAS as a probe of Double Parton Scattering (DPS).</td>
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<tr>
<td>66</td>
<td>Jason Yue</td>
<td>University of Sydney NSW AUSTRALIA</td>
<td>An inclusive dilepton analysis</td>
<td>Cross sections of tbar, WW and Z??t production are measured at the ATLAS detector from pp collisions at ?? = 7 TeV in the e? channel. Systematics of the analysis are examined using sigma ET – Njets phase space.</td>
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<td>67</td>
<td>Morteza Aramesh</td>
<td>University of Melbourne VIC AUSTRALIA</td>
<td>Fabrication, Characterisation &amp; Optical Properties of Silver Nanowires in NanoPorous Alumina Templates</td>
<td>We report fabrication and optical properties of electrochemically deposited silver nanowires into the nano-porous alumina template.</td>
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<tr>
<td>68</td>
<td>Christopher Artlett</td>
<td>Macquarie University NSW AUSTRALIA</td>
<td>Ranged Remote Sensing of Water Temperature using Raman Spectroscopy</td>
<td>In this work we investigate depth-resolved remote sensing of water temperature using Raman scattering. Spectral features are analysed for effective temperature measurement parameters. Laboratory-based remote sensing experiments are conducted using a 5 metre water cell.</td>
</tr>
</tbody>
</table>
Plasmonic Periodic Arrays of Single and Double Silver Cylinders, and the Effects of a Metallic Layer

Motivated by applications in surface-enhanced spectroscopies, we report enhancement of electric field and tailored extinction in a bi-dimensional periodic array of single and double silver nanocylinders over a silver layer.

Cavity-Enhanced Optomechanics with Cold Atoms

A theoretical model of cavity-enhanced interactions between cold atoms and optomechanical systems is presented, and experimental progress towards this goal is reported. Such systems may allow improved mechanical cooling and quantum state preparation.

Brownian Motion of Nonspherical Particles in Optical Tweezers

The force field of an optically trapped nonspherical particle is mapped by considering a potential, averaged over many orientations from Brownian motion. We investigate how accurately the pseudopotential represents the average force in optical tweezers.

Quantum memory as a linear optical network

We present a proposal for using a series of optical quantum memories as a linear optical network. The network is optically configurable to perform arbitrary unitary transformations of frequency multiplexed optical states.

Near Field Broadband Phase Imaging using Fresnel and Iterative Techniques

We present an algorithm and experimental layout which has the potential to overcome inherent complications due to a broadband laboratory source, and is capable of conducting phase imaging using Fresnel diffraction and iterative techniques.

Optical Polarisation and Depolarization of Electronic Spin and Some Other Unresolved Questions in the Physics of Nitrogen-Vacancy Centres in Diamond

Nitrogen-vacancy centres in diamond display anomalous saturation behaviour which we investigate and conclude that a well-known optically induced spin polarization in these crystal defects is counterbalanced by optically induced spin depolarization.

We study the detuned surface plasmon resonance in polarization space for continuous-wave multilayered optical recording medium based on plasmonic nanorods. We also explore the progressively twisted NR alignment in multilayer for a potential recording medium.

We propose a method for characterizing the orientation distribution of anisotropic nanoparticles such as plasmonic gold nanorods by image correlation spectroscopy. This method is superior to the conventional polarization transmission method.

The usefulness and application of ellipsoidal nanowires is considered along with current control challenges and how these are being overcome.

The usefulness and application of ellipsoidal nanowires is considered along with current control challenges and how these are being overcome.

Precision measurement of motion using SNOM

Abstract – we propose a high precision measurement of nanoparticle motion by observing the optical transmission from a SNOM (scanning near field optical microscope) probe, giving a spatial resolution of 10-13 m/Hz^{1/2}. 
**Superchiral electromagnetic fields from localised surface plasmons**

Superchiral electromagnetic fields have a chirality exceeding that of circularly polarized light. We discuss the generation of superchiral fields by surface plasmon resonances in metal nanostructures.

---

**Tuning Magnetic Metamaterials with Liquid Crystals**

We study both experimentally and numerically the effect of liquid crystal alignment and anchoring on the tunability of optical magnetic metamaterials. We demonstrate controlled tuning of the metamaterials response by applying an electric field.

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**Cross-Shaped Aperture Optical Antenna Array**

Report on the variation of resonant cavity modes in the visible regime with respect to changes in the geometry of cross-shaped slot antenna arrays in metallic thin films.

---

**Development of Prototype Retro-reflectors for the Gravity Recovery and Climate Experiment Follow-up Mission**

The manufacture and testing of two alternative designs of retro-reflectors are described. These are prototype components of a proposed interferometric ranging system for the Gravity Recovery and Climate Experiment follow-up, capable of detecting relative length changes of 10-15m.

---

**Ion-assisted Deposition of Protected Silver Nanoparticle Films**

The application of ion-assisted deposition to the manufacture of stable multilayer plasmonic silver structures for surface-enhanced Raman spectroscopy (SERS) is described. Longevity data and analysis of the results are presented.

---

**Ion Beam Sputtered Multilayer Coating of Optics for the Laser Interferometer Gravitational-Wave Observatory**

The application and metrology of multilayer ion beam sputtered coatings on some of the principal optical elements of the Advanced Laser Interferometer Gravitational-Wave Observatory (LIGO) are described.

---

**Towards Cavity Enhanced Laser Absorption Spectroscopy for Isotopic Ratio Measurement**

We present a technique to measure the molecular absorption of carbon dioxide, based on cavity enhanced amplitude modulated laser absorption spectroscopy (CEAMLAS), with the aim of developing an instrument for isotopic ratio measurements.

---

**Vanadium Dioxide based tunable optical antennas**

Nanoscale metallic particles have been integrated with the phase-change material Vanadium Dioxide (VO2) to investigate modulation of their resonant modes. These will form the basis of tunable optical antennas.

---

**Cross Section Measurement of Nanoparticle with Polarization-interferometric Confocal Microscope**

Polarization-interferometric nonlinear confocal microscopy is proposed for measuring a nano-sized particle with optical anisotropy. The anisotropy in the particle was spectroscopically imagined through a three-dimensional distribution of third-order nonlinear dielectric polarization photoinduced.

---

**Optics of Spider Orb Web Capture Droplets Modelled as Elliptical Micro-lenses**

An elliptical micro-lens is proposed as a model for the optical function of capture droplets on certain spider orb webs. The optics of elliptical lenses is largely unstudied. Ray tracing within 2-D cross-sections is used.
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<td>89</td>
<td>Matthew Arnison</td>
<td>Canon Information Systems Research Australia NSW AUSTRALIA</td>
<td>3D Alignment Using a Chiral Phase Aperture Mask</td>
<td>We propose an extension of alignment using image correlation to 3D, using a chiral phase aperture mask. Microscope simulations show a transverse accuracy of 1 nm and a depth accuracy of 3 nm.</td>
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<td>90</td>
<td>Ken Grant</td>
<td>Defence Science and Technology Organisation SA AUSTRALIA</td>
<td>Ship-to-Shore Free Space Optical Communications</td>
<td>This paper describes a novel analogue FM ship-to-shore free space optical communications system, which was used to demonstrate video and bi-directional audio transmission up to 3 km.</td>
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<tr>
<td>91</td>
<td>Ken Grant</td>
<td>Defence Science and Technology Organisation SA AUSTRALIA</td>
<td>Estimation of Refractive Index Structure Constant by Measurement of Angle-of-arrival Variation at 1.55um</td>
<td>The refractive index structure constant is estimated along a 1.5km path using the angle-of-arrival technique, and the results are compared to those taken concurrently with a commercial boundary layer scintillometer.</td>
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<td>92</td>
<td>Steven Hinckley</td>
<td>Edith Cowan University WA AUSTRALIA</td>
<td>Gamma Irradiation Effects in Fibre Bragg Gratings</td>
<td>This paper reports on a preliminary study of gamma radiation effects on the current generation of optical fibre Bragg grating sensors as a function of dose rate, and the effects of relaxation after gamma irradiation.</td>
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<td>93</td>
<td>Steven Hinckley</td>
<td>Edith Cowan University WA AUSTRALIA</td>
<td>Low-Cost Educational Optical Coherence Tomography System for Thickness Measurements</td>
<td>We have developed an inexpensive rudimentary low coherence interferometer that can be used to measure sample thickness in the micron to mm range, and for exploring educational aspects of interferometry and optical coherence tomography.</td>
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<td>94</td>
<td>Sarah Walden</td>
<td>Queensland University of Technology QLD AUSTRALIA</td>
<td>SHG in nanostructured thin gold films</td>
<td>The plasmon-plasmon contribution to SHG in thin gold films investigated experimentally and theoretically. The dependence of the SHG on fundamental wavelength, film thickness and film structure are of particular interest.</td>
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<td>95</td>
<td>Sarah Walden</td>
<td>Queensland University of Technology QLD AUSTRALIA</td>
<td>Enhancing Raman scattering signals through increased gold film reflectivity</td>
<td>The observed increase of a factor of 7 in Raman signals at 785 nm of nitrobenzene adsorbed onto thin gold films shown to be a result of the increased reflectivity of the film.</td>
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<td>96</td>
<td>Baohua Jia</td>
<td>Swinburne University of Technology VIC AUSTRALIA</td>
<td>Hybrid photonic crystals for emission manipulation</td>
<td>Hybrid photonic crystals fabricated using the multi-photon direct laser writing method combined with the electroless deposition of silver have been employed to control the spontaneous emission of near-infrared core-shell quantum dots.</td>
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<td>97</td>
<td>Nikita Kostylev</td>
<td>University of Western Australia WA AUSTRALIA</td>
<td>Plasmon-Assisted Enhancement of Magneto-Optical Effects in Periodic Arrays of Ferromagnetic Nanostripes</td>
<td>One-dimensional periodic arrays of ferromagnetic nanostripes are shown to enhance Transverse Magneto-Optical Kerr Effect by an order of magnitude. Nanostripe-coupled Surface Plasmon Resonance is found to be responsible for this phenomenon.</td>
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<tr>
<td>98</td>
<td>Timothy Lam</td>
<td>Australian National University ACT AUSTRALIA</td>
<td>Polarization insensitive strain sensor</td>
<td>Random wander in polarization orientation of optical fibers can cause accuracy degradation in high performance strain sensing systems. We present a strain sensing measurement technique capable of extracting longitudinal displacement independent of polarization induced phase fluctuations.</td>
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<tr>
<td>99</td>
<td>Andrew Lee</td>
<td>Macquarie University NSW AUSTRALIA</td>
<td>Low threshold diode pumped solid-state THz source</td>
<td>We report a compact, solid-state terahertz (THz) radiation source that operates with a very low diode pump threshold of 2.5 W, generates 6.45 μW average output power, and is frequency-tunable across the range 1.65-2.65 THz.</td>
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<td>100</td>
<td>Jipeng Lin</td>
<td>University of Sydney NSW AUSTRALIA</td>
<td>Cascaded self-Raman lasers based on 382 cm⁻¹ shift in Nd:GdVO₄</td>
<td>We report quasi-continuous-wave, cascaded Nd:GdVO₄ self-Raman lasers based on a secondary Raman transition at 382 cm⁻¹. Multiple laser lines were obtained at both infrared and visible regions by incorporating intracavity sum-frequency mixing.</td>
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<td>101</td>
<td>Timothy Van Der Laan</td>
<td>CSIRO NSW AUSTRALIA</td>
<td>Self-Assembled Vertically-Standing Graphene Nanosheets on Alumina Template</td>
<td>An efficient plasma-enhanced chemical vapour deposition technique has been used to grow vertically-standing graphene nanosheet pattern on highly-ordered, free-standing alumina template. Various properties of the graphene nanosheets are investigated.</td>
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<td>102</td>
<td>Jim Williams</td>
<td>University of Western Australia WA AUSTRALIA</td>
<td>The Scattering of Free Electrons by Free Electrons</td>
<td>Free 2000 eV electron-electron angular differential (e,e) scattering measurements agree with Born approximation and indicate quantum diffraction and symmetry reduce the cross section by orders of magnitude below the classical values around 90° scattering angle.</td>
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<td>103</td>
<td>Sarah Adlong</td>
<td>Australian National University ACT AUSTRALIA</td>
<td>Robustness of a system-filter separation for the feedback control of a Bose-Einstein condensate</td>
<td>We consider the application of estimation-based feedback control to a Bose-Einstein Condensate in a harmonic trap under continuous measurement, and show that it can successfully cooled in the presence of reasonable experimental limitations.</td>
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<td>104</td>
<td>Muhammad Hamid Ahmed</td>
<td>RMIT University VIC AUSTRALIA</td>
<td>Realistic Spin Guides</td>
<td>We report calculations showing the guidance of individual magnons in one-dimensional spin chains for applications in quantum information transport. In particular, we show the effect of confinement potential, disorder, and realistic materials parameters.</td>
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<td>105</td>
<td>Rafael Alexander</td>
<td>University of Sydney NEW SOUTH WALES AUSTRALIA</td>
<td>Efficient Use of Temporal-Mode Continuous-Variable Cluster States</td>
<td>We consider the efficiency of measurement-based quantum computation with optical temporal-mode continuous-variable cluster states, comparing two schemes for information encoding in terms of the efficiency with which they use squeezing resources.</td>
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<td>106</td>
<td>Ping Koy Lam</td>
<td>Australian National University ACT AUSTRALIA</td>
<td>Fast real-time random numbers from vacuum fluctuations</td>
<td>We present a robust quantum random number generator based on measuring the quantum fluctuations of the vacuum field. This is one of the fastest in the world with a throughput of 5.7 Gbits per second.</td>
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<td>107</td>
<td>Adam Bennet</td>
<td>Griffith University QLD AUSTRALIA</td>
<td>Experimentally characterising nonlocal correlations in entanglement swapping</td>
<td>We experimentally demonstrate that local models describing pairs of independent, uncorrelated system photonic entanglement swapping experiments are violated by quantum correlations for visibilities as low as 50%, contrasted with 66% in the standard analysis.</td>
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<td>108</td>
<td>Christopher Bentley</td>
<td>Australian National University ACT AUSTRALIA</td>
<td>Fast Gates for Trapped Ions</td>
<td>We present a simple, implementable ion trap scheme for 30ns phase gates; a quarter of the trap period. This is three orders of magnitude faster than previously achieved gates.</td>
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<td>109</td>
<td>Julien Bernu</td>
<td>Australian National University ACT AUSTRALIA</td>
<td>Characterisation and Optimisation of Gradient Echo Memory Using Cold Atoms</td>
<td>Many quantum memory experiments now use cold atomic ensembles, as they promise long storage times and high efficiencies. We present the first detailed characterisation and optimisation of the gradient echo memory scheme with cold atoms.</td>
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<td>110</td>
<td>Sylvain Blanvillain</td>
<td>University of Sydney NSW AUSTRALIA</td>
<td>Suppressing On-Chip EM Crosstalk for Spin Qubit Devices</td>
<td>We report the development and performance of on-chip interconnects designed to suppress electromagnetic crosstalk in spin qubit device with the large number of gate. Low temperature measurement and numerical simulation confirm that control and readout signal crosstalk can be suppressed to levels of order 1%, from dc to 1 GHz.</td>
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<td>111</td>
<td>Andrew Bolt</td>
<td>University Of Queensland AUSTRALIA</td>
<td>Scalable Mesurement Based Fault-Tolerant Quantum Communication</td>
<td>We present a fault-tolerant measurement based scheme for creating encoded Bell pair resources on foliated CSS codes. We supplement this with an efficient decoding scheme for CSS Turbo codes based on belief propagation.</td>
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<td>112</td>
<td>Allen Boston</td>
<td>Griffith University QLD AUSTRALIA</td>
<td>Operational use of Discord in an Extended State Merging Protocol</td>
<td>We experimentally investigate discord and its possible use as a measure of resource use in extended state merging operations. This is done with entangled single photons using both polarization and spatial degrees of freedom.</td>
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<td>113</td>
<td>George Brawley</td>
<td>University of Queensland QLD AUSTRALIA</td>
<td>Towards Room Temperature Quantum Optomechanics in a Microsphere-Nanostring System</td>
<td>Measurements of the optomechanical coupling rate of a system comprising of a high-Q nanostring mechanical element evanescently coupled to an optical microsphere have shown potential for cooperativity sufficient to observe quantum effects such as radiation pressure backaction at room temperature.</td>
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<td>114</td>
<td>Jacob Bridgeman</td>
<td>University of Sydney NSW AUSTRALIA</td>
<td>Multiscale Entanglement Renormalization Ansatz Study of Spin Chains with a Line of Criticality</td>
<td>Ground state energies and conformal data extracted from a MERA simulation of critical quantum lattice models are presented. The Ashkin-Teller, XXZ and perturbed cluster models are discussed with regard to their respective c=1 CFTs.</td>
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<td>115</td>
<td>Michael Bromley</td>
<td>University of Queensland QLD AUSTRALIA</td>
<td>Atomic Sagnac Interferometry with Bose-Einstein Condensates</td>
<td>We have computationally explored the Sagnac effect using a novel theoretical scheme involving localised Bose-Einstein condensates. We find, remarkably, that instead of a linear accumulation of the phase shift with time, we find phase plateaus.</td>
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<td>116</td>
<td>Michael Bromley</td>
<td>University of Queensland QLD AUSTRALIA</td>
<td>Vortex Eigenstates of Bose-Einstein Condensates</td>
<td>We have computationally investigated the production of excited eigenstates of the non-linear Schrödinger equation. Our focus is on the generation of Bose-Einstein condensates with multiple vortices imprinted, and their stabilisation using internal boundary conditions.</td>
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<td>117</td>
<td>Andre Carvalho</td>
<td>Australian National University ACT AUSTRALIA</td>
<td>Quantum computing with incoherent resources and quantum jumps</td>
<td>We show that all the fundamental blocks needed to perform quantum computation can be built from the addition of an extra decoherence channel followed by a suitable measurement strategy.</td>
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<td>118</td>
<td>Helen Chrzanowski</td>
<td>Australian National University ACT AUSTRALIA</td>
<td>Discord as a Quantum Resource for Bi-Partite Communication</td>
<td>We present an operational method to exploit discord as a physical resource, demonstrating that the discord within a bipartite system can be consumed to encode information that can only be accessed by coherent quantum interactions.</td>
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<td>119</td>
<td>Helen Chrzanowski</td>
<td>Australian National University ACT AUSTRALIA</td>
<td>Photon number discrimination using only Gaussian resources and measurements</td>
<td>We experimentally demonstrate a protocol for accessing the statistics of the non-Gaussian Schrödinger kitten state using only continuous variable resources.</td>
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<td>120</td>
<td>James Cresser</td>
<td>Macquarie University NSW AUSTRALIA</td>
<td>Coarse-Grained Master Equations And Heat Transport Fluctuation Theorems For Open Quantum Systems</td>
<td>We derive novel phase-entanglement and spin-squeezing criteria that are immune to number fluctuations. These are utilized to obtain an operational definition of relative phase-measurement sensitivity, via analysis of quantum entanglement in atom interferometry.</td>
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<td>121</td>
<td>Nicola Dalla Pozza</td>
<td>University of Padova ITALY</td>
<td>Adaptive Discrimination for Quantum PPM signals</td>
<td>In the scenario of binary communication over a noisy quantum channel we study the region of admissible transition probabilities between transmitted and received symbol. We then derive the quantum state and measurement operators that yield the best performance in terms of error probability or mutual information.</td>
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<td>122</td>
<td>Andrew Darmawan</td>
<td>University of Sydney NSW AUSTRALIA</td>
<td>Interpolating Between Spin Models with Universal Ground States</td>
<td>We study the relationship between the AKLT model and the cluster model by considering an interpolating path of Hamiltonians. These spin models are physically distinct yet are both universal computational resources.</td>
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<td>123</td>
<td>Tommaso Demarie</td>
<td>Macquarie University NSW AUSTRALIA</td>
<td>Topologically ordered states with continuous variables modes on a 2D lattice</td>
<td>Topological entanglement entropy detects topologically ordered states. We investigate several different measures of topological entropy for finitely squeezed continuous variables toric codes and comment on their physical interpretation.</td>
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<td>124</td>
<td>Chandni Doshi</td>
<td>La Trobe University VIC AUSTRALIA</td>
<td>Characterisation of a CsI(Tl) Scintillator for Indirect X-ray Detection by Simulation and Experiment</td>
<td>The energy dependent point spread function of a commercial indirect imaging X-ray detector was modeled, validated using synchrotron radiation and extended to polychromatic sources. The results can be used for optimization of an imaging system.</td>
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<td>125</td>
<td>Kate Ferguson</td>
<td>Australian National University ACT AUSTRALIA</td>
<td>Cavity enhanced rephased amplified spontaneous emission</td>
<td>This work describes progress towards demonstrating cavity enhanced rephased amplified spontaneous emission (RASE) in a rare-earth ion doped solid. This is a source of on demand single photons and could be used to demonstrate a discrete-variable quantum repeater.</td>
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<td>126</td>
<td>Natasha Gabay</td>
<td>University of Sydney NSW AUSTRALIA</td>
<td>Optical Continuous-Variable Cluster States as Spin States</td>
<td>We interpret continuous-variable cluster states as spin states using the Schwinger representation of SU(2). We compare the entanglement structure in the two pictures, with the goal of using such states in fault-tolerant quantum computing.</td>
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<td>127</td>
<td>Adil Gangat</td>
<td>University of Queensland QLD AUSTRALIA</td>
<td>Mechanical Schrodinger Cats via the Attractive Bose-Hubbard model in a Superconducting Circuit</td>
<td>We propose a scheme to generate entangled coherent states in coupled microwave resonators and subsequently transfer them to an array of micromechanical oscillators.</td>
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<td>128</td>
<td>Todd Green</td>
<td>University of Sydney NSW AUSTRALIA</td>
<td>Generalised Noise Filtering for Arbitrary Single-Qubit Control Operations</td>
<td>We present a novel analytical method for calculating the effect of environmental noise on arbitrary single-qubit control sequences. The qubit fidelity is conveniently expressed in terms of the noise power spectrum and generalised filter functions.</td>
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129  Joseph Ho  
Centre for Quantum Dynamics QLD AUSTRALIA  
Realising Noiseless Linear Amplification Using Weak Measurements  
We experimentally demonstrate that nondestructive weak measurements on an optical mode can be used to implement heralded noiseless linear amplification of quantum states of the mode.

130  Anthony Hope  
RMIT University VIC AUSTRALIA  
Coherent Tunneling Adiabatic Passage in thin-ridge silicon waveguides  
Coherent tunneling adiabatic passage is a robust method for transferring information between quantum states. We describe a novel basic quantum logic element and its implementation with silicon integrated photonic circuits.

131  Nicholas Miller  
RMIT University VIC AUSTRALIA  
Thermophoresis in Nanofluidic Colloidal Fluids  
We predict the temperature dependent concentration profiles across colloidal fluids confined by planar walls, by independently obtaining transport coefficients for a bulk fluid and applying them to the continuum mechanics relation of temperature and concentration.

132  Timothy Nicholson  
University Of Queensland QLD AUSTRALIA  
Understanding the Processibility of Starch Polymers  
A multi-pass rheometer has been used to reliably measure the viscoelastic properties of starch plasticised by various combinations of water and glycerol.

133  Ranganathan Prabhakar  
Monash University VIC AUSTRALIA  
A Unified Microstructural Constitutive Model for Stresses in Unentangled Polymer Solutions  
A new model is proposed for stresses in polymer solutions that accounts for screening of intra- and intermolecular hydrodynamic and excluded-volume interactions when molecules elongate and overlap in strongly stretching flows.

134  Cindy September  
University of Queensland QLD AUSTRALIA  
Rheology And Flow Behaviour Of Thickened Infant Formulae  
This work investigates the rheological properties of thickened infant formulae [TIF] in order to improve the care of infants with dysphagia; a common symptom of being born prematurely or with developmental disorders.

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**Wednesday 12 December 2012**

**1700 – 1830**  
**Poster Session 2**  
**Room: Tyree Room / Leighton Hall in the John Niland Scientia Building**

**1**  
Neil Broderick  
University of Auckland NEW ZEALAND  
Energy Scalable Giant Chirp Oscillator Mode-locked with a Nonlinear Amplifying Loop Mirror  
We report on an environmentally stable all-fiber all-PM giant chirp oscillator modelocked with a nonlinear amplifying loop mirror. The oscillator delivers pulses with energies exceeding 10 nJ that can be recompressed below 500 fs.

**2**  
Qiang Liu  
Macquarie University NSW AUSTRALIA  
Investigation of Laser Processing of Tb3+ doped Borosilicate Glasses  
For the first time we explore femtosecond laser writing in Tb3+ doped borosilicate glasses using athermal writing inscription. We present studies of single mode guidance and photodarkening effects.

**3**  
Neil Broderick  
University of Auckland NEW ZEALAND  
Real-time Signle-Shot and Coherence Measurement of Noise-like Pulses  
We present the first real-time single-shot and coherence measurement of noise-like pulses generated in Yb ANDi laser with Raman process.
4 Yanhua Luo
University of New South Wales NSW AUSTRALIA

Developing Bi/Er/Al Codoped Optical Fibre with High Bi Concentration for Ultrabroadband Emission

We report the development of Bi/Er/Al codoped optical fibre with high Bi concentration with the in-situ modified chemical vapor deposition (MCVD) technique, which shows ultrabroadband emission from 1100-1570 nm pumped by different laser sources.

5 Jianzhong Zhang
Harbin Engineering University CHINA

A new broadband light source based on Bismuth and Erbium co-doped fiber developed in UNSW

Here she would present the results of a new broadband source and the amplifier experiments based on Bi/Er codoped fiber by UNSW

6 Francis Bennet
Australian National University ACT AUSTRALIA

Adaptive Optics Demonstrator for Precision Laser Tracking and Orbital Modification of Space Debris

We present the development of an adaptive optics demonstrator utilising a ground based laser to track and precisely range orbiting space debris, including a 10kW CW laser to modify the orbit of debris with photon pressure.

7 Allan Ernest
Charles Sturt University NSW AUSTRALIA

Does Quantum Wavepacket Expansion Influence Cosmic Evolution?

Incorporating a universal quantum wavefunction into Einstein-de Sitter cosmology provides an explanation of dark energy that, using the observable mass of the universe as the only free parameter, predicts the observed behaviour of cosmic evolution.

8 Allan Ernest
Charles Sturt University NSW AUSTRALIA

Quantum Overlap Integrals for Large n

We extend previous calculations of the overlap integrals for radial dipole decay rates involving large principal quantum numbers and examine trends in the behavior of these as a function of level spacing.

9 Dmitry Fursa
Curtin University WA AUSTRALIA

Relativistic convergent close-coupling calculation of the spin polarization of electrons scattered elastically from cadmium, zinc, and mercury

We present spin asymmetry parameters (Sherman functions) for elastic electron scattering on cadmium, zinc, and mercury calculated using the relativistic convergent close-coupling (RCCC) method.

10 Joseph Builth-Williams
Flinders University SA AUSTRALIA

Dynamical (e,2e) Studies of Bio-Molecules

Triply differential cross sections are presented for electron impact ionization of a number of bio-molecules including pyrimidine, tetrahydrofurfuryl alcohol and tetrahydropyran. Experimental results are compared with theoretical calculations performed using the M3DW model. Keywords: (e,2e); tetrahydrofurfuryl alcohol; pyrimidine; tetrahydropyran; tetrahydrofuran

11 Madalyn Casey
James Cook University QLD AUSTRALIA

Positron Thermalisation in Atomic and Molecular Gases

A general numerical technique has been developed based on Boltzmann’s kinetic theory for positron transport in gases. The technique has been applied to describe the temporal relaxation of positrons in atomic and molecular gases.

12 Luca Chiari
Flinders University SA AUSTRALIA

Electronic excitation cross sections for low-energy electron collisions with Î±-tetrahydrofurfuryl alcohol

Differential cross sections for the electron-impact excitation of the important biological compound Î±-tetrahydrofurfuryl alcohol are reported. The experimental cross sections are measured for incident electron energies in the 15-50 eV range for scattering angles between 10-90°.
13  Simon Haine  
University of Queensland QLD AUSTRALIA  
Squeezing the most out of your atom interferometer: Information recycling for enhanced quantum sensing.  
Atom interferometry provides very sensitive measurements of rotations and accelerations. We investigate enhancing the sensitivity of atom interferometers via atom-light entanglement.

14  Jacob Hughes  
Centre for Antimatter-Matter Studies ACT AUSTRALIA  
A Magnetised Beam for Low Energy Electron Scattering Experiments  
A novel electron scattering technique has been developed to investigate low-energy electron interactions with atomic and molecular targets. This method has been developed from positron scattering techniques and uses strong magnetic fields to confine an electron beam.

15  Alisher Kadyrov  
Curtin University WA AUSTRALIA  
Fully Differential Study of Positron-Impact Ionisation of Hydrogen  
The fully differential cross section for positron-impact ionisation of hydrogen is calculated in a first-order perturbation approach using a three-body continuum wave function satisfying the correct asymptotic boundary conditions in all domains relevant to breakup.

16  Dmitry Konovalov  
James Cook University QLD AUSTRALIA  
S-wave e-He scattering below ionization threshold  
The electron-Helium S-wave scattering problem (below ionization threshold) is solved very accurately by describing both target electrons within the configuration-interaction model of helium.

17  Alexander Kozlov  
University of New South Wales NSW AUSTRALIA  
Dipole Moments and Extension of the Schiff Theorem to Ions and Molecules  
The possibility of observation of PT-odd nuclear moments in atoand molecules is investigated. It is shown that in ions of experimental interest nuclear EDM effect exceeds the rest of the moments, while in molecules Schiff moment dominates.

18  Prince Kurumthodathu Surendran  
Swinburne University of Technology VIC AUSTRALIA  
Magnetic Lattices for Ultracold Atoms  
We report on the trapping and evaporative cooling of 87Rb F=1 atom in one-dimensional 10 micrometer-period magnetic lattice. Potential applications of sub-micron-period square, triangular and honeycomb lattices to simulate condensed matter systems are discussed.

19  Jim Mitroy  
Charles Darwin University NT AUSRAU  
Relativistic Description of Atomic Structure Using S-spinors and L-spinors  
A relativistic description of the structure of heavy atousing S-spinors and S-spinors has been developed and applied to the description of alkali atoand ions. The methodology will be described and results presented.

20  Dennis Mueller  
University of Texas, UNITED STATES OF AMERICA  
Development of a Positron Reaction Microscope  
We are developing a positron reaction microscope at the Centre for Antimatter/Matter Studies (CAMS) to make kinematically complete measurements of positron scattering from atoand simple molecules. We will present some of the associated challenges.

21  Ly Duong  
Australian National University ACT AUSTRALIA  
Velocity-map imaging of O-photodetachment at wavelengths producing O(1D2) atoms  
The kinetic energy and angular distribution of electrons photodetached from O has been measured using the technique of velocity-map imaging, providing meV resolution. The energy dependent anisotropy parameter for detachment producing O(1) oxygen is similar to that for ground state oxygen atoms.

22  Andrew Ong  
University of New South Wales NSW AUSTRALIA  
Optical Transitions in Highly Charged Ions: New Clocks with Enhanced Effects of Variation of the Fundamental Constants  
We propose a new type of atomic clock based on optical transitions in highly charged ions. Such clocks would be extremely accurate and would have huge sensitivity to potential variation of the fine-structure constant.
23 Benjamin Roberts
University of New South Wales NSW AUSTRALIA

Atomic Parity Violation as a Test of the Standard Model and Unification Theories
Atomic parity violation calculations in cesium are improved and used to analyse measurements to test the Standard Model and unification theories.

24 Marianna Safronova
University of Delaware UNITED STATES OF AMERICA

Precision Calculation of Blackbody Radiation Shifts for Optical Frequency Metrology
We show that four group IIIIB divalent ions, B, Al+, In+, and Tl+ have anomalously small blackbody radiation (BBR) shifts of the ns2 1S0 – nsp nP0 clock transitions.

25 Jeremy Savage
Curtin University WA AUSTRALIA

Comparison of spherical and spheroidal expansions for the energies and oscillator strengths of H2+
We compare bound state energies and oscillator strengths of H2+ calculated using configuration interaction expansions in both spherical and spheroidal coordinates. These convergence studies have important implications for applying the CCC methodology to molecular scattering.

26 Tapio Simula
Monash University VIC AUSTRALIA

Majorana Boson and Seven Quantized Vortices
We have found a Bose-Einstein condensate, in which the continuous rotation symmetry is broken by an array of seven quantized vortex lines, to be capable of supporting a zero energy Majorana boson quasi-particle mode.

27 Wade Tattersall
Australian National University ACT AUSTRALIA

Monte Carlo Simulations of Low Energy Swarm Transport in Soft-condensed Media
We present a novel Monte Carlo code for simulation of electron and positron transport in soft-condensed media, utilising a static structure approach to account for material structural properties. The results of these simulations are compared with Boltzmann equation solutions and other Monte Carlo treatments of similar systems.

28 Jim Williams
University of Western Australia WA AUSTRALIA

Topological Phase in Electron Exchange Excitation with Dissociation in Simple Molecules
Observations of the linear and circular polarizations of the Balmer-alpha radiation from hydrogen-containing molecules after spin-polarized electron exchange excitation-with-dissociation scattering indicate orientation and alignment of the electron charge cloud are searched for a topological phase.

29 Darren Alvares
University of New South Wales CSIRO NSW AUSTRALIA

Ink-jet Printed Nanoparticle Film Tactile Sensors: Substrate Effect
Tactile sensors in robotics and prosthetics require flexibility and fabrication via low cost large area techniques. In nanoparticle strain gauges the choice of substrate affects not only its manufacturability but also its performance. This paper also compare the characteristics of nanoparticle film tactile sensors on rubber and plastic substrates.

30 Tina Gorjiara
University of Sydney NSW AUSTRALIA

3D Dosimetry for Proton Cancer Therapy
This study quantitatively evaluates a new system which shows promising potential for 3D dosimetry of heavy particles used in cancer hadrontherapy. The water and tissue equivalency and dose response of a novel 3D dosimeter were investigated using both Monte Carlo modeling and experimental approaches.

31 Mushtaq Loan
Jinan University ACT AUSTRALIA

Cell Response to Proton Radiation in the Low Energy Transfer Regime
Using the Universal Model for growth of a cell system, we study the analytic behaviour of cell response to positively charged particles, protons. Our results indicate a near-quadratic survival trends in the low energy transfer regime.
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<td>Dale Prokopovich</td>
<td>Australian Nuclear Science and Technology Organisation NSW AUSTRALIA</td>
<td>Design and Characterisation of a Detector System for Imaging of I-125 in Freely Moving Mice</td>
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<td>Jason McLaren</td>
<td>University of South Australia SA AUSTRALIA</td>
<td>Data Analysis Techniques in Imaging Photoplethysmography</td>
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<td>Liudmila Uvarova</td>
<td>Moscow State University RUSSIAN FEDERATION</td>
<td>Discrete model of competition hematopoetic cells as basic factor of symptoblood oncology disease</td>
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<td>Alex Bukoski</td>
<td>University of Missouri UNITED STATES OF AMERICA</td>
<td>Critical Slowing for Two Hodgkin-Huxley Neuron Models Near Spiking Threshold</td>
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<td>Ben Kent</td>
<td>Australian Nuclear Science and Technology Organisation NSW AUSTRALIA</td>
<td>Probing Membrane Sugar Interactions with Neutron Membrane Diffraction</td>
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<td>Jung-Ha Kim</td>
<td>University of Sydney NSW AUSTRALIA</td>
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<td>Ehsan Negahbani</td>
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<td>Martin Wong</td>
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<td>42</td>
<td>David Cortie</td>
<td>Australian Nuclear Science and Technology Organisation NSW AUSTRALIA</td>
<td>Picosecond Electron-Hole Dynamics Leading To Terahertz Emission From Semiconductor Surfaces Visualised with a Computer Games Engine</td>
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<td>A 3D ensemble Monte Carlo transport simulation was used to model the photocurrent diffusion excited by a femtosecond laser pulse at a semiconductor surface leading to a plasma oscillation and emission of terahertz electromagnetic radiation.</td>
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<td>43</td>
<td>Evgeny Galakhov</td>
<td>Russian Peoples’ Friendship University RUSSIAN FEDERATION</td>
<td>Situation of Blow-Up for Higher Order Differential Inequalities</td>
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<td>Many physical phenomena can be described by nonlinear inequalities with singular coefficients. In the present work, conditions of blow-up for solutions of such inequalities are established.</td>
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<td>Ra Inta</td>
<td>Australian National University ACT AUSTRALIA</td>
<td>Hardware Acceleration of Parallel Algorithms</td>
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<td>Researchers increasingly rely upon hardware accelerators such as the General Purpose Graphical Processor Unit (GPGPU) for parallel algorithms. We present a computing system that combines the benefits of the two most widely used hardware accelerators.</td>
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<td>Hidetoshi Konno</td>
<td>University of Tsukuba JAPAN</td>
<td>Characterization of Ventricular Fibrillation in 2D Beeler-Reuter Model by Stochastic Predator-Prey Dynamics</td>
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<td>Characterization of 2D Beeler-Reuter model under ventricular fibrillation is presented by using various stochastic predator-prey (PP) models with multiplicative noise. It is shown that the PP models can catch various features of fluctuations of BR model.</td>
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<td>46</td>
<td>Laura Rosales-Zárate</td>
<td>Swinburne University of Technology VIC AUSTRALIA</td>
<td>Applications of Fermionic Phase-Space Methods</td>
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<td>We will present two applications of the Gaussian phase representation for fermions. These include the evaluation of the linear entropy in phase-space and a construction of a fermionic many-body Q-function and observables.</td>
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<td>47</td>
<td>Alexander Sukov</td>
<td>Russian State Geological Prospecting University N.A.S. Ordzhonikidze RUSSIAN FEDERATION</td>
<td>Scattering of Waves by Metamaterial Coated Periodic Surface: Mathematical Modeling</td>
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<td>Scattering of a monochromatic plane electromagnetic E[H] – polarized wave by dielectric coated an infinitely conducting periodic (corrugated) surface is investigated. It is assumed that the boundary of the configuration consists of two surfaces: a plane top dielectric surface and bottom surface which is periodic in one direction. A dielectric coating is medium with negative refractive index (metamaterial). The original problem is reduced to the solution of a system of integral equations. Some numerical results for surface with sinusoidal (cycloidal) profile are presented.</td>
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<td>The energy-state of a vibro-impacting vibration energy harvester strongly determines the available output power. Based on the Hyster-Hertz contact model, the probability-of-existence of high energy-states for a vibro-impacting harvester is examined.</td>
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<td>Guochu Deng</td>
<td>Australian Nuclear Science and Technology Organisation NSW AUSTRALIA</td>
<td>Simulation of an Energy Dispersive Mode for RITA-type Cold Neutron Triple Axis Spectrometer SIKA</td>
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<td>The energy dispersion mode of the triple axis spectrometer SIKA has been simulated for the multiplexing configuration. The energy resolutions at two different wavelengths are estimated.</td>
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<td>50</td>
<td>Richard Mole</td>
<td>Australian Nuclear Science and Technology Organisation NSW AUSTRALIA</td>
<td>Pelican: a multipurpose time-of-flight cold neutron spectrometer</td>
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<tr>
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<td>Pelican is the new cold neutron, time of flight spectrometer at the Bragg Institute.</td>
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<td>51</td>
<td>Christine Rehm</td>
<td>Australian Nuclear Science and Technology Organisation NSW AUSTRALIA</td>
<td>The Kookaburra Ultra-Small-Angle Neutron Scattering (USANS) Instrument at ANSTO</td>
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<td>The new ultra-small-angle neutron scattering (USANS) instrument Kookaburra, currently under construction at the ANSTO OPAL reactor, will allow characterisation of microstructures covering length scales in the range of 0.1 micrometres to 10 micrometres.</td>
</tr>
</tbody>
</table>
52  Anton Stampfl  
Australian Nuclear Science and Technology Organisation NSW AUSTRALIA  
A Be-Filter Based Neutron Spectrometer for Vibrational Spectroscopy: Simulations and Tests  
A Be-filter based neutron spectrometer being built at the Bragg Institute is described and some examples of its use given.

53  Sudarshan Kathi  
University of Western Australia WA AUSTRALIA  
Positron Re-emission Energy Spectroscopy of Thin Fe Film on W (100)  
Positron re-emission measurements from Fe film grown on W(100) at very low positron incident energies give insights into the mechanism of energetic positron re-emission.

54  Sam Moore  
University of Western Australia WA AUSTRALIA  
Characterisation of Nanostructured Thin Films  
The electronic and optical properties of thin films have been investigated using Total Current Spectroscopy (TCS) and Ellipsometry. The focus has been on the exhibition of plasmonic effects by so-called “metallic black” films.

55  Jim Williams  
University of Western Australia WA AUSTRALIA  
Plasmonic Structure in Thin Film (e,2e) Spectra  
Plasmonic structures are explored in (e,2e) spectra from carbon, aluminium, polyvinyl formal and pyroxylin films using asymmetric 3 keV coplanar scattering dynamics for transmission and reflection geometries. Characteristic multiple plasmon excitation and elastic scattering dominate.

56  Andrew Charles  
Bureau of Meteorology VIC AUSTRALIA  
The Liquid-Vapour Interface of a Pure Fluid Modelled with Smooth Particles  
A liquid-vapour system is modeled using a diffuse interface model, numerically solved using a smooth particle method. An artificial broadening of the interface has consequences for the accurate representation of density gradient forces.

57  Paul Guagliardo  
University of Western Australia WA AUSTRALIA  
Positron Annihilation Studies of Metal Oxide Systems  
Metal oxides are an important basis in thin film technology, catalysis, and solid-state devices. In this study, positron annihilation has been applied to study cation vacancy formations in a number of metal oxide systems due to doping.

58  Anna Paradowska  
Australian Nuclear Science and Technology Organisation NSW AUSTRALIA  
Distribution of the Residual Stress in Plates Treated by Iterative Laser Forming  
Iterative laser forming can be applied to reduce weld induced distortions. In laser forming, thermally induced strains transverse to the laser scan line vary with depth in the material and contribute most significantly to the desired deformation.

59  Liudmila Uvarova  
Moscow State University of Technology RUSSIAN FEDERATION  
Modeling of heat and mass transfer in systems with fractal surface  
The methods for constructing mathematical models of surface roughness in the problem of heat and mass transfer with moving and fixed boundaries, as well as the analysis of fractal and more general models of rough surfaces, is investigated in temperature fields near a surface.

60  Xanthe Croot  
University of Sydney NSW AUSTRALIA  
Population Inversion and Spin Blockade in a Driven Double Quantum Dot  
We observe microwave-driven transitions between the ground and excited states of single and two-electron GaAs double quantum dots. Microwaves couple the qubit to its bosonic environment, resulting in a population inversion of the two-level system.

61  Sudarshan Kathi  
University of Western Australia WA AUSTRALIA  
Low Energy Positron Beam Studies at UWA: Slow Positron Interactions with W(100) Surface  
Positron re-emission and scattering from a W(100) surface have been measured. At low incident energies the re-emission yield increased with energy but was very sensitive to competing channels like elastic scattering.
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<td>Emma Mitchell</td>
<td>CSIRO NSW AUSTRALIA</td>
<td>Nanostructured Josephson Junctions for SQUID and Microwave Resonator Devices</td>
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<td>Matthew Shortell</td>
<td>Queensland University of Technology QLD AUSTRALIA</td>
<td>Characterisation of ZnO QDs using Optical Methods.</td>
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<td>Jackson Smith</td>
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<td>Electronic Transport In Low-dimensional Nanostructures Using A Semi-empirical Green's Function Method</td>
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<td>Chih-Hwan Henry Yang</td>
<td>University of New South Wales NSW AUSTRALIA</td>
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<td>Kelly Walker</td>
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<td>Correlated charge transport in linear and bilinear Josephson junction arrays</td>
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<td>67</td>
<td>Boyuan Cai</td>
<td>Swinburne University of Technology VIC AUSTRALIA</td>
<td>Metallic nanodots for enhanced a-Si solar cells</td>
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<td>Neamul Hayet Khansur</td>
<td>University of New South Wales NSW AUSTRALIA</td>
<td>Combined X-ray and Neutron Structural Refinements of (Bi0.5Na0.5)0.94Ba0.06TiO3 Lead-free Piezoelectrics</td>
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<td>69</td>
<td>Erich Kisi</td>
<td>University of Newcastle NSW AUSTRALIA</td>
<td>Preparation and Characterisation of LaB6 Using a Novel and Simple Synthesis Route</td>
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<td>70</td>
<td>Erich Kisi</td>
<td>University of Newcastle NSW AUSTRALIA</td>
<td>Miscibility gap alloys for high thermal conductivity – high energy density thermal storage</td>
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</table>
Self-Propagating High-Temperature Synthesis of Mn+1Xn and Mn+1AXn Phases

Mn+1AXn phases such as Ti3AlC2 with interesting combinations of thermal, electrical and mechanical properties potentially useful in energy conversion applications have been synthesized from commercial grade starting powders using SHS.

New Germanate Glasses For Infrared Fibre Applications

We report new germanate glasses that are attractive materials for mid-infrared optical fibres with high nonlinearity, high gain and enhanced stability. We demonstrate basic properties and extruded fibre fabrication for the new glasses.

Investigation of POF Grating Spectrum Under Constant Tensile Stress

We report the first observation of the time dependent evolution of spectrum profile of POF grating loaded constant tensile stress attributed to the combination effect of the viscoelasticity and the non-uniformity of POF grating.

Wavelength Scanning of SOA Based Fiber Ring Laser for Gas Humidity Detection using Photonic Crystal Fiber

A semiconductor optical amplifier (SOA) based fiber ring laser for humidity detection is demonstrated. Wavelength scanning is introduced into the ring using distributed feedback (DFB) laser and photonic crystal fiber acts as a sensing element.

Characterisation of Microfabricated Optical Fibre for Gas Sensing

Microchannels drilled in standard and hollow core optical fibres are studied using a novel probing technique. This allows optimization of the interaction with the fibre core, enabling the demonstration of methane sensing.

Optimisation of Power Detection Interrogation Methods for Fibre Bragg Grating Sensors

We present a method to optimise the performance of power detection interrogation system for fibre Bragg grating sensors. The performance of the different systems can be optimised in terms of sensitivity and/or dynamic range.

Between X-ray optical effects, modulated structures and coherent phonons

Both time-integrated and time-resolved X-ray diffraction has been applied to silicon crystals, modulated by static structures as in optical band-gap material, and by ultrasonic waves. On the one hand, the modulation fields can be characterized in space and time, on the other, multiple diffraction effects can be used for interesting optics in the X-ray regime.

A New Method for Measuring Nanoparticle Sizes in the Optical Far Field

We demonstrate a new method of measuring nanoparticle sizes using optical surface profilometry that is not constrained by traditional diffraction limits.

Light-driven chiral meta-atoms

We study the opto-mechanical properties of chiral meta-atoms and find that twisted split-ring resonators can be used as a general prototype of subwavelength light-driven actuators over a wide range of frequencies.

Developing Ultrafast Raman Laser Sources

We aim to develop ultrafast Raman laser sources to extend the wavelength accessibility of two important mode-locked lasers: Ti:Sapphire & VECSELs. These ultrafast Raman lasers generating new wavelengths can have significant application in biophotonics.
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<td>Alireza Maleki</td>
<td>Macquarie University NSW AUSTRALIA</td>
<td>Coupling light beams into planar surface plasmon structures</td>
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<td>Pris are used for coupling incident light with plasmonic structures. We introduce nanoparticles onto a multilayer asymmetric plasmonic waveguide, scattering the propagating plasmons into localized resonances, to improve coupling and detection of surface plasmons.</td>
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<td>Tim Mapperson</td>
<td>University of Melbourne VIC AUSTRALIA</td>
<td>Template-Directed Assembly Of Plasmonic Nanostructures</td>
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<td>We present progress on fabrication of novel plasmonic elements by template-directed assembly. We show that position and orientation of nanostructures can be reliably controlled in a scalable wet-chemistry approach to produce plasmonic nanostructures.</td>
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<td>Sara Marzban</td>
<td>Australian National University ACT AUSTRALIA</td>
<td>Progress towards the development of rare-earth doped waveguides for quantum communications applications</td>
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<td>The suitability of rare-earth doped waveguides for quantum memory applications is investigated using the high resolution laser techniques, spectral holeburning and photon echo measurements.</td>
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<td>Peter McGlynn</td>
<td>RMIT University VIC AUSTRALIA</td>
<td>Stray Light Correction Method for a New Ozone Spectrophotometer</td>
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<td>Stray light effects set a limit to the accuracy of column ozone determinations made with a spectrophotometer. These effects can be reduced with optical filters, and a numerical subtraction algorithm using a correction matrix.</td>
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<td>Mutthavarapu Mallikharjuna Rao</td>
<td>University of Wollongong NSW AUSTRALIA</td>
<td>Emissivity of Globar in T Hz Spectral Range</td>
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<td>A common form of source is a ‘blackbody’ such as the globar. The emissivity of such radiators in the terahertz range is not well known. Here we estimate it using combined theory and experiment approach.</td>
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<td>A.S.M. Mohsin</td>
<td>Swinburne University of Technology VIC AUSTRALIA</td>
<td>Plasmon Coupling of Gold Nanoparticles for Probing Membrane Proteins</td>
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<td>In this paper we present a feasibility study of the plasmon coupling of gold nanoparticles for its potential probe for image correlation spectroscopy. This technique will be applied to understand membrane protein aggregation.</td>
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<td>87</td>
<td>Gabriel Molina-Terriza</td>
<td>Macquarie University NSW AUSTRALIA</td>
<td>The role of symmetries in the interaction of light with nanoparticles</td>
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<td>In this presentation, we will show some of our latest results on the interaction of light with nanoparticles. We have found that using the fundamental role of the underlying symmetries or lack of symmetries of the system, allow for a powerful technique to understand the interaction.</td>
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<td>88</td>
<td>Vincent Ng</td>
<td>Macquarie University NSW AUSTRALIA</td>
<td>Nonlinear Plasmonics: Second-Harmonic Generation of Long Range Surface Plasmon Polaritons</td>
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<td>We investigate second-harmonic generation in a symmetric plasmonic waveguide by exploiting the dielectric nonlinearity of periodically-poled lithium niobate.</td>
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<td>Timo Nieminen</td>
<td>University of Queensland QLD AUSTRALIA</td>
<td>Dynamic Simulation for Efficient Modelling of Optical Tweezers with Many Degrees of Freedom</td>
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<td>Dynamical simulation of optical tweezers, including Brownian motion and viscous drag, allows efficient modelling when there are degrees of freedom, such as when nonspherical particles, or multiple particles, are trapped.</td>
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<td>Timo Nieminen</td>
<td>University of Queensland QLD AUSTRALIA</td>
<td>Modelling complex Optically-Driven Micromachines via Basic Building Blocks</td>
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<td>Complex optically-driven micromachines can be represented as built up from basic building blocks. This representation can be used to calculate the force and torque on the micromachine using a multiple scattering algorithm.</td>
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91 Ana Andres Arroyo
University of New South Wales NSW AUSTRALIA

Controlling Phase in Wide Photonic Band-gap Structures
Gires-Tournois resonances modulate the phase of reflected light in one-dimensional photonic band gap structures. This can be used to fabricate novel photonic devices, such as wavelength selective wave plates and tunable optical filters.

92 Alexander Sabella
Defence Science and Technology Organisation SA AUSTRALIA

Impact of pump polarisation and linewidth on the 1064 nm Raman gain coefficient of diamond
We present measurements on the Raman gain coefficient of diamond up to 12 cm/GW at 1064 nm. Maximum gain is achieved when pumping with polarization aligned with the <111> crystal axes and linewidths less than 1 cm⁻¹.

93 Juna Sathian
Queensland University of Technology QLD AUSTRALIA

Temporal Phase Characteristics of the Amplitude Noise in Electro-optic Phase Modulator
Our results demonstrate that both magnitude and phase of EOM amplitude noise vary temporally because of photorefractive self-defocusing. This is particularly important in low noise applications where high stability of residual amplitude modulation is essential.

94 Arif M. Siddiquee
Swinburne University of Technology VIC AUSTRALIA

Two-Photon Excited Luminescence from Gold Nanorods
Combined effect of surface plasmon resonance and lightning rod factor will be analysed for gold nanorods due to two photon excited luminescence (TPL). Gold nanorods TPL intensity will be measured by varying excitation wavelength.

95 Graham N Smith
OptoFab, Macquarie University NSW AUSTRALIA

Advances in femtosecond laser micro-inscription of optical coherence tomography phantoms
Demonstration of advances in femtosecond laser subsurface micro-inscription fabricating 3-dimensional point and line refractive index modifications (defects) to create optical coherence tomography (OCT) phantoms for calibration and validation of OCT system performance.

96 Izabela Spaleniak
Macquarie University NSW AUSTRALIA

Integrated Photonic Lanterns: Multimode to Single Mode Light Converters for Applications in Astronomy
We are using a femtosecond laser to inscribe a series of integrated photonic lanterns that have a range of geometry parameters in order to determine the ideal format for optimising the single-mode to multimode transition efficiency.

97 Sebastian Stark
Macquarie University NSW AUSTRALIA

Widely tunable CW Lasers in the deep-UV
We present CW lasing in Ce:LiCAF, tunable between 280 and 315 nm, when pumped by the resonant-enhanced second-harmonic of a diode-pumped solid-state laser.

98 Michael Steel
Macquarie University NSW AUSTRALIA

Purcell Effect in Magnetodielectric Cylinders
We show that the radiation dynamics of a source inside a composite magneto-dielectric cavity involves an interplay between Purcell and local-field effects which cannot be captured by the refractive index alone.

99 Yue SUN
Australian National University ACT AUSTRALIA

Oscillatory Instabilities in Two-mode Nano-cavities with Tailored Optomechanical Potentials
We analyze nonlinear dynamics of coupled suspended nano-cavities where static optomechanical potentials can be engineered through the simultaneously excited two optical modes, and demonstrate that self-induced oscillations can appear even at the deep potential minima.

100 Jason McLaren
University of South Australia SA AUSTRALIA

Analysis of Scintillation Statistics from Atmospheric Turbulence
We have investigated the ability of a number of probability density functions (PDFs) to model atmospheric scintillation statistics. We find that the log normal and the Beckmann PDFs best fit the experimental data.
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<td>101</td>
<td>Jason McLaren</td>
<td>University of South Australia</td>
<td>Simultaneous Investigation of the Scintillation of UV, Visible and IR Wavebands</td>
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<td>SA AUSTRALIA</td>
<td>Atmospheric turbulence induces intensity fluctuations in a propagating signal, and hence can affect the performance of a variety of optical systems. The scintillation of UV, Visible and IR wavebands were simultaneously investigated in this study.</td>
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<td>102</td>
<td>Jonathan Tollerud</td>
<td>Swinburne University VIC AUSTRALIA</td>
<td>Demonstration of a stable and flexible coherent multi-dimensional spectroscopy apparatus to study coherent coupling in asymmetric double quantum wells</td>
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<td>A flexible, stable coherent multi-dimensional spectroscopy apparatus using spatial light modulators to shape beatemporally and spatially is developed and used to characterize coherent coupling dynamics in asymmetric GaAs double quantum wells.</td>
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<td>103</td>
<td>Liudmila Uvarova</td>
<td>Moscow State University of Technology RUSSIAN FEDERATION</td>
<td>Interaction of electromagnetic waves with non-homogenous non-spherical disperse particles</td>
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<td>The principle of the Huygens ðPoincare’s for determination the inner electromagnetic field and the absorbed electromagnetic energy in non-homogenous non ðspherical particles is used. The results were received for the dependencies of complex dielectric permittivity and magnetic permeability on x (one from coordinates of considered system).</td>
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<td>104</td>
<td>Priyamvada Venugopalan</td>
<td>Swinburne University of Technology VIC AUSTRALIA</td>
<td>Dual-Wavelength Focusing by a Far-field Plasmonic Lens</td>
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<td>We report on the dual-wavelength far-field focusing by a plasmonic lens with an annular slit and a concentric groove. The far-field nano-focusing of two different wavelengths in such a plasmonic lens is studied numerically.</td>
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<td>105</td>
<td>Thanh Phong Vo</td>
<td>Macquarie University NSW AUSTRALIA</td>
<td>Surface Plasmon Propagation on Gold Striplines</td>
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<td>We report our study of surface plasmon propagation on gold stripe-lines with passive and active substrates using leakage radiation microscopy and near-field scanning optical microscopy</td>
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<td>106</td>
<td>Wan Zakiah Wan Ismail</td>
<td>Macquarie University NSW AUSTRALIA</td>
<td>Investigation of scattering and random lasing phenomena using dielectric and metal nanoparticles</td>
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<td>We investigate scattering and random lasing with dielectric and metal nanoparticles in terof spectral narrowing and emission intensity.</td>
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<td>107</td>
<td>Thomas Woodley</td>
<td>Queensland University of Technology QLD AUSTRALIA</td>
<td>Designing a Plasmonic EIT Array</td>
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<td>We are interested in using plasmonic nanoparticle arrays to achieve electromagnetically induced transparency hence have undertaken to explore the effect of the thickness (height from the substrate) of the nanoparticles on the induced dark mode.</td>
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<td>108</td>
<td>Rui Feng Kan</td>
<td>Anhui Institute of Optics and Fine Mechanics CHINA</td>
<td>Fiber optic remote monitoring system for methane gas in the coal mining industry</td>
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<td>Fiber optic remote gas monitoring system based on tunable diode laser absorption spectroscopy (TDLAS) technology has been developed and demonstrated for remotely monitoring the concentration of mining methane gas at multiple locations.</td>
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<td>Qiming Zhang</td>
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<td>Broad-band Nano-focusing with Aperture Larger than Î/2 in Air</td>
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<td>We report on the design and numerical study of nano-focusing by a photonic crystal immersion lens with aperture larger than /2 in air. A focus spot of lateral resolution /3 can be achieved in multiple normalised frequencies.</td>
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<td>110</td>
<td>Lixin Zhang</td>
<td>Macquarie University NSW AUSTRALIA</td>
<td>Time-resolved Spectrometry Characterization of Single Up-conversion Nanocrystals using a 32-Channel PMT Array</td>
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<td>We constructed a time-resolved spectroscope by a confocal scanning microscopy system and a 32-channel PMT device. This provides time-resolved spectra for quantitative characterization of single nanocrystals with different doping and morphological properties.</td>
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</table>
111  **Barbara Zittermann**  
Macquarie University NSW AUSTRALIA  

**Mode-Locked Deep UV Lasers Based on Ce:LiCAF**  
Ce:LiCAF lasers, with their 35 nm gain bandwidth centered at 290 nm, have the potential to generate attosecond UV pulses. We will present our latest results, in experiment and modeling, in our effort to reach this goal.

112  **Joss Bland-Hawthorn**  
University of Sydney NSW AUSTRALIA  

**Measurements Techniques for Multi-core Fibre Bragg Gratings**  
Multi-core fibre Bragg gratings are an attractive possibility for atmospheric hydroxyl (OH) suppression in astrophotonics but their characterization is very time intensive and cumbersome. We discuss the performance measurement techniques and propose an IR camera based technique.

113  **Ginu Rajan**  
University of New South Wales NSW AUSTRALIA  

**Etching and Its Effects On Gratings Inscribed In Singlemode Polymer Optical Fiber**  
Etching and its effects on polymer optical fiber (POF) Bragg gratings are investigated from a sensing application perspective. Two processes of fabricating etched POF grating, namely, inscription after etching and etching after inscription, are compared.

114  **Kevin Cook**  
University of Sydney NSW AUSTRALIA  

**Regenerating Gratings Under Strain**  
Tens of nanometers of tunability in the Bragg wavelength of regenerated gratings within two different types of fibers have been investigated by applying a load of 3 gram at an annealing temperature of 1100 °C (exceeding 32 nm).

115  **Kevin Cook**  
University of Sydney NSW AUSTRALIA  

**Temperature and strain characterisation of type I and regenerated gratings in boron-codoped germanosilicate fiber**  
Temperature and strain characterisation of seed and regenerated gratings with and without post-annealing is reported. Results at high temperatures differ from those at lower temperatures.

116  **Andrew Watts**  
University of Sydney NSW AUSTRALIA  

**Characterisation of Photoinduced Chalcogenide (As2S3) Microfibre Resonators**  
We report photosensitive tuning of chalcogenide microfibre resonators and compare with theoretical calculations to explain the transmission spectrum and modal properties. The photosensitive modification of the refractive index is shown to be strongly intensity dependent.

117  **Giovanni Guccione**  
Australian National University ACT AUSTRALIA  

**Optomechanics of a Nanomechanical Oscillator Inside a High Finesse Cavity**  
We study the interaction between intra-cavity optical field and a nano-mechanical oscillator placed inside an optical cavity. We will investigate possibility of laser cooling of a nanowire by tuning the cavity and the nanowire parameters.

118  **Michael Hush**  
Australian National University ACT AUSTRALIA  

**Removing the Effect of Quantum Noise in a Bose Einstein Condesate with Active Feedback**  
We find quantum noise produces previously unseen heating in BEC under active feedback. We perform the most complete simulation of the system to date and discover this additional heating can be removed with additional controls.

119  **Seiji Armstrong**  
Australian National University ACT AUSTRALIA  

**Multi-mode Quantum Networks**  
We report on the experimental preparation of various multi-mode entangled states, with the ability to switch between them in real-time. Up to 8-mode entanglement is measured with just one detector.

120  **Jan Jeske**  
RMIT University VIC AUSTRALIA  

**Quantum Decoherence Due to Spatially Correlated Fluctuations in the Environment**  
We present a general formalism to model quantum decoherence caused by environmental fluctuations with a certain spatial correlation length and present some resulting effects relative to the spatial extend of the quantum system.
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<td>Alexander Judge</td>
<td>University of Sydney NSW AUSTRALIA</td>
<td>Canonical Quantization of Macroscopic Electrodynamics in Magneto-Electric Media</td>
<td>We present a Hamiltonian for electrodynamics in lossy, dispersive, magneto-electric media, and diagonalize its canonical quantum counterpart. Our results provide a rigorous framework for classical and quantum optics in negative-index materials.</td>
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<td>122</td>
<td>Karen Kheruntsyan</td>
<td>University of Queensland QLD AUSTRALIA</td>
<td>Hong-Ou-Manel Effect with Ultracold Atoms</td>
<td>Using a pair of colliding Bose-Einstein condensates and a sequence of appropriately tuned Bragg pulses, we propose to realize a two-particle interferometry setup that exhibits a Hong-Ou-Mandel dip, demonstrating strong quantum correlations in matter waves.</td>
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<td>123</td>
<td>Mirko Lobino</td>
<td>Griffith University QLD AUSTRALIA</td>
<td>Quantum metrology on a biological sample</td>
<td>We use an integrated opto-fluidic device that couples a waveguide interferometer with a microfluidic channel to measure the concentration of a blood protein in an aqueous buffer solution using two-photon entangled states.</td>
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<td>124</td>
<td>Xiwang Luo</td>
<td>University of Queensland QLD AUSTRALIA</td>
<td>Diffusion Effects in Gradient Echo Quantum Memory</td>
<td>The diffusion effects in gradient echo quantum memory were studied. We present both the analytical and numerical results, and also suggest ways to reduce these effects to get higher memory efficiency for long storage time.</td>
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<td>125</td>
<td>Tamara Martin</td>
<td>University of Sydney NSW AUSTRALIA</td>
<td>Spin Resonance in Organic Light Emitting Diodes</td>
<td>We investigate spin-dependent electronic processes in pi-conjugated polymers in a device architecture. We integrate magnetic resonance excitation capabilities into our device, for the purpose of performing electron-nuclear double resonance (ENDOR) measurements.</td>
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<td>126</td>
<td>Nathan McMahon</td>
<td>University of Queensland QLD AUSTRALIA</td>
<td>Optimisation of Quantum Noiseless Linear Amplifiers</td>
<td>We investigated the optimisation of noiseless probabilistic quantum amplifiers, which have been achieved for weak signal coherent states. The current device was improved upon and similar devices were investigated for stronger signal states.</td>
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<td>127</td>
<td>Peter Morrison</td>
<td>Morrison Industrial Company NSW AUSTRALIA</td>
<td>Qubits, Qutrits: Quantum Computation and Control</td>
<td>Links between time dependent matrix mechanics, the quantum brachistochrone and various finite quantum systems are explored using a novel systematic method. Various unitary operators are constructed for qubits, qutrits and biqubits to demonstrate the use of this technique.</td>
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<td>128</td>
<td>Nicolas Menicucci</td>
<td>University of Sydney NSW AUSTRALIA</td>
<td>Graphical Calculus for Gaussian Pure States</td>
<td>We provide a simple graphical calculus for all Gaussian pure states, including graph transformation rules for all local Gaussian unitary operations and quadrature measurements.</td>
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<td>Casey Myers</td>
<td>Centre for Engineered Quantum Systems QLD AUSTRALIA</td>
<td>Enhanced Quantum Transport in an Opto-Mechanical System</td>
<td>We investigate enhancing the quantum transport of a single photon along a linear array of coupled cavities by including time dependently driven mechanical resonators in each cavity via a radiation pressure coupling.</td>
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<td>130</td>
<td>Matthew Palsson</td>
<td>Griffith University QLD AUSTRALIA</td>
<td>Experimentally Demonstrating Reference Frame Free Bell Inequality Violations</td>
<td>Experimental demonstration of Bell inequality violation with 39.7±0.1% probability in a scenario where two parties share no reference direction in comparison with the theoretical expected value of 41.3%.</td>
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<td>Saleh Rahimi-Keshari</td>
<td>University of Queensland</td>
<td>Verification of Quantum Discord</td>
<td>We introduce an experimental method for verifying quantum discord of an unknown bipartite quantum state, which can be applied on discrete and continuous systems. We show that states with Gaussian discord have nonzero quantum discord.</td>
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<td>Jacopo Sabbatini</td>
<td>University of Queensland</td>
<td>Engineered topological defects in coupled binary Bose-Einstein condensates</td>
<td>We use the miscible-immiscible phase transition in coupled binary Bose-Einstein condensates to engineer and manipulate topological defects. We investigate the possibility of creating non-local quantum superpositions of topological defects.</td>
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<td>Alexander Soare</td>
<td>University of Sydney</td>
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<td>134</td>
<td>William Soo</td>
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<td>Agile microsystem for the implementation of robust quantum control protocols in 117Yb+</td>
<td>We present and discuss the design, construction, and characterization of an agile quasi-optical microwave system for quantum control of the 12.6 GHz hyperfine transition in trapped Ytterbium ions.</td>
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<td>135</td>
<td>Ben Sparkes</td>
<td>Australian National University</td>
<td>Precision Spectral Manipulation Using a Coherent Optical Memory</td>
<td>The ability to coherently spectrally manipulate quantum information has the potential to improve qubit rates across quantum channels and find applications in optical quantum computing. We present work demonstrating spectral manipulation using gradient echo memory</td>
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<td>136</td>
<td>Alex Szorkovszky</td>
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<td>Thermomechanical Squeezing Below 3dB</td>
<td>We demonstrate 5 dB of thermomechanical squeezing of the motion of a cantilever, breaking the 3 dB limit to parametric squeezing for the first time. This is applicable to quantum squeezing at low temperatures.</td>
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<td>137</td>
<td>Nathan Walk</td>
<td>University of Queensland</td>
<td>Security of Continuous Variable Quantum Cryptography with Gaussian Post-selection</td>
<td>We introduce a ‘Gaussian’ post selection and demonstrate that the security can be unconditionally bounded using only experimentally accessible quantities. We find improvements over all pre-existing continuous variable protocols in realistic regimes.</td>
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<td>138</td>
<td>Matthew Wardrop</td>
<td>University of Sydney</td>
<td>A Two-Qubit Exchange Gate Proposal for Singlet-Triplet Quantum Dot Qubits</td>
<td>We propose a two-qubit exchange gate for singlet-triplet qubits that has high fidelities and short operation times comparable to the single qubit exchange gate operations now routinely performed.</td>
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<td>139</td>
<td>Till Weinhold</td>
<td>University of Queensland</td>
<td>Ultra-narrow single photons fro atomic gradient echo memory storage</td>
<td>Atomic quantum memories have bandwidths much narrower than single photons used in quantum communication making them incompatible. We use cavity-based parametric down-conversion to generate photons tailored for storage in gradient echo memories</td>
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<td>140</td>
<td>Morgan Weston</td>
<td>Centre for Quantum Dynamics</td>
<td>Experimental Investigation of a Quantum Joint Measurement Uncertainty Relation</td>
<td>Using weak measurements of photonic quantum systems, we demonstrate that a generalized joint measurement uncertainty principle holds even for those cases that cannot be validly described by the well-known Arthurs-Kelly joint measurement relation.</td>
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Dominic Williamson  
University of Sydney NSW AUSTRALIA  
**Holonomic Quantum Computation within the Gapped Ground States of Spin Chains Possessing Symmetry Protected Topological Order**  
We investigate the use of adiabatic holonomies on gapless boundary modes of spin chains which lie in nontrivial symmetry protected topological phases to achieve quantum computation.

James Wood  
University of Melbourne VIC AUSTRALIA  
**Interaction Assisted Quantum Magnetometry**  
Improved magnetometry sensitivity using a system of interacting Nitrogen Vacancy (NV) centers was investigated theoretically. Via optimised pulse sequences, sensitivity improvements were shown. Enabling detection at increased NV densities would lead to further sensitivity improvement.

Keyu Xia  
Macquarie University NSW AUSTRALIA  
**Ground State Cooling of a Nanomechanical Resonator via Superconducting Qubit**  
Via enabling the collective excitation, we propose a ground state cooling scheme, operating in the weak confinement regime, for a nanomechanical resonator by coupling it to two coupled flux qubits.

Manjin Zhong  
Australian National University ACT AUSTRALIA  
**Hyperfine Decoherence Study of Europium-doped Crystals in High Magnetic Field**  
We present here a study on hyperfine decoherence mechanism of europium doped crystals in high magnetic field. The aim of the study is maximizing the hyperfine coherence times for quantum memory applications.

Yevgeny Stadnik  
University of New South Wales NSW AUSTRALIA  
**Dense spectrum of resonances, and scalar, spinor and vector particle capture in a near-black-hole metric**  
We show that a dense spectrum of resonances emerges for massless scalar, spinor and vector particles incident on a body near the black hole limit, with black hole absorption properties borne out in the black hole limit. Thus quantum effects create black hole properties before the actual formation of the black hole.

John Steele  
University of New South Wales NSW AUSTRALIA  
**Conformal Vectors in Surface Homogeneous Spacetimes**  
The conformal vector equations in surface homogeneous space-times can be reduced to one equation in three unknowns. We examine earlier results on physically important solutions using this new approach.

Geethaka Devendra  
RMIT University VIC AUSTRALIA  
**Comparative Analysis of Silicon-on-Insulator Waveguide Designs for Nonlinear Optic Applications**  
We analyze four available silicon waveguide geometries as platform for self phase modulation, accounting for both linear and nonlinear two photon absorption losses. We find that each waveguide has merit depending on application constraints.

Mr Andrew See  
University of New South Wales NSW AUSTRALIA  
**The Influence of Small-Angle Scattering on Ballistic Transport in Quantum Dots**  
We show that the electrical characteristics of undoped quantum dots are remarkably robust to room temperature thermal cycling. Unlike conventional modulation-doped dots, we obtain magnetoconductance fluctuations that are reproducible under repeated thermal cycling.
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<td>1700</td>
<td>Central Room</td>
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<td>Mason Thomas</td>
<td>Mon 10 Dec</td>
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<td>McKendrick David</td>
<td>Wed 12 Dec</td>
<td>1330</td>
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<td>Concentration Session 8C — Quantum Information, Concepts and Coherence 8: Optomechanics</td>
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<td>McCamley Dave</td>
<td>Thu 13 Dec</td>
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<td>Concentration Session 10B — Condensed-Matter, Materials and Surface Physics 10: Semiconductors-I</td>
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<td>McKinnon David</td>
<td>Thu 13 Dec</td>
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<td>McKinnon David</td>
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<td>Concentration Session 4D — Atomic and Molecular Physics 4: Cold Atoms / BEC</td>
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<td>Concentration Session 10F — Condensed-Matter, Materials and Surface Physics 1.3: Instruments &amp; Methods</td>
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<td>Thu 11 Dec</td>
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<td>McKinnon Russell</td>
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<td>Wed 12 Dec</td>
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<td>McMahen Aimee</td>
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<td>McMillie Steve</td>
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<td>Tue 11 Dec</td>
<td>1330</td>
<td>Central Lecture Block 6</td>
<td>Concentration Session 5C — Quantum Information, Concepts and Coherence 5: Quantum Information Theory</td>
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<td>McMillie Nickolas</td>
<td>Tue 11 Dec</td>
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<td>McMillie James</td>
<td>Wed 12 Dec</td>
<td>1330</td>
<td>Central Lecture Block 7</td>
<td>Concentration Session 9A — Optics, Photonics and Lasers 9: Non-linear Optics 2</td>
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<td>McMillie Maggs</td>
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<td>McMillie Muhammed</td>
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<td>McMillie Richard</td>
<td>Mon 10 Dec</td>
<td>1330</td>
<td>Central Lecture Block 5</td>
<td>Concentration Session 28 — Condensed-Matter, Materials and Surface Physics 2. Bulk Magnetism</td>
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<td>1530</td>
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<td>Concentration Session 28 — Condensed-Matter, Materials and Surface Physics 2: Bulk Magnetism</td>
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<td>Nguyen Thanh</td>
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<td>Nunes Hamminger</td>
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<td>Nuti Francesco</td>
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<td>Concurrent Session 1B — Condensed-Matter, Materials and Surface Physics 12: Spin Chains, Spin Ladders and Spin Ice</td>
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<td>Pomyllio Christopher</td>
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<td>Concurrent Session 10F – Condensed-Matter, Materials and Surface Physics 13: Instruments &amp; Methods</td>
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<td>Tirm Stephan</td>
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<td>Concurrent Session 12A – Optics, Photonics and Lasers 12: Nanomeasurement</td>
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<td>Tobor Michael</td>
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<td>Central Lecture Block 4</td>
<td>Concurrent Session 4E – Nuclear and Particle Physics 4</td>
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**Notes:**
- All sessions are conducted in different rooms and blocks across the conference days.
- The schedule includes a variety of topics ranging from physics to biology, indicating a broad range of scientific discussions.
- Multiple sessions are scheduled on the same day and time, highlighting the dense schedule of the conference.
- The conference extends from Mon 10 Dec to Thu 13 Dec, covering a full week of presentations and discussions.
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<thead>
<tr>
<th>Name</th>
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A critical part of our science and our success is collaboration. We thrive on working with new people with new perspectives.

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The Institute for Photonics & Advanced Sensing (IPAS) is one of five research institutes at The University of Adelaide. IPAS fosters excellence in research in materials science, chemistry, biology and physics, and across these boundaries, and develops disruptive new tools for measurement.

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We work to create new tools that will change the questions scientists can ask, stimulate the creation of new industries, and create a new profession of transdisciplinary problem solvers.

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- **Environmental & agricultural monitoring** – laser radar systems for monitoring wind, moisture and pollution in the atmosphere, sensors for monitoring soil and water quality.
- **Medical diagnostics** – rapid virus detection to help prevent global flu pandemics, early detection of cancer biomarkers and technologies to improve IVF success rates.
- **Food & wine** – monitoring of wine maturation, soil nutrient monitoring.

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